Hydrology Technical Study Tentative Tract 17423

City of Costa Mesa, Orange County, CA

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1 INTRODUCTION

This study addresses the hydrologic impacts associated with the proposed development of Tentative Tract 17423 (project), located in the City of Costa Mesa, California. The City of Costa Mesa is located in the County of Orange; refer to Exhibit 1: Regional Vicinity Map. The project site is at 2626 Harbor Boulevard at the corner for Harbor Boulevard and Merrimac Way; refer to Exhibit 2: Local Vicinity Map.

The project consists of the construction of thirty-three (33) residential lots, one (1) private street, and seven (7) open space lots on approximately 3.71-acres.

This report is a technical engineering study/evaluation to be used solely to support the environmental document for the project on issues related to drainage, and surface hydrology. The level of analysis prepared is compatible with the level of planning information available.

All assessments and technical analysis in this report are in compliance with the local drainage policies and requirements for the City of Costa Mesa, Orange County, and the California Environmental Quality Act (CEQA) of 1970, as amended. The hydrology analysis has been prepared at a preliminary engineering level based upon the details of the available information for an environmental document.

1.1 History/Background

The project site is located in a highly urbanized coastal plain of Orange County. The site is south of the Santa Ana River, and is located within the Santa Ana Delhi Watershed which s tributary to the Upper Newport Bay.

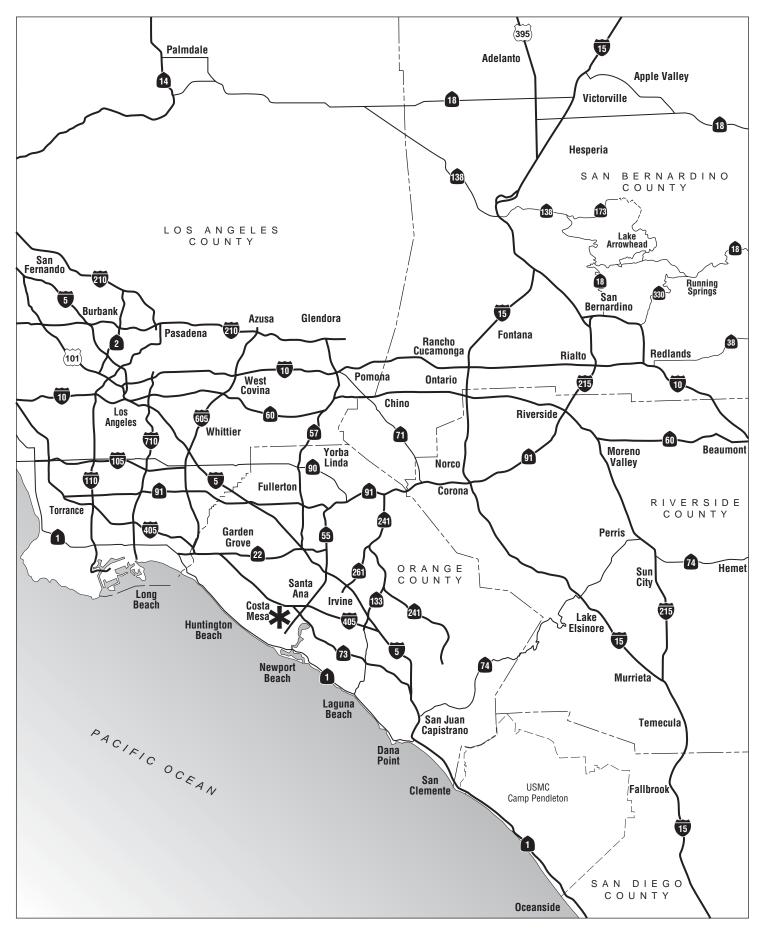
1.2 Definition of Level of Significance

The purpose of this technical evaluation is to determine the impact of the proposed residential development on hydrology, and floodplains within the study area. Should the analysis determine that the proposed project significantly impacts the drainage patterns, hydrology, or floodplains, appropriate mitigation will be identified to minimize the project impacts to less than significant levels.

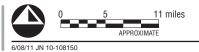
1.2.1 Flood Control Criteria

Federal, state, and local drainage laws and regulations govern the evaluation of impacts to surface water drainage. For this evaluation, impacts to surface water drainage would be considered significant if the project alters the drainage patterns of the site, resulting in substantial erosion, siltation, or increased run-off that would result in increased flooding in downstream facilities.

Exhibit 1: Regional Vicinity Map

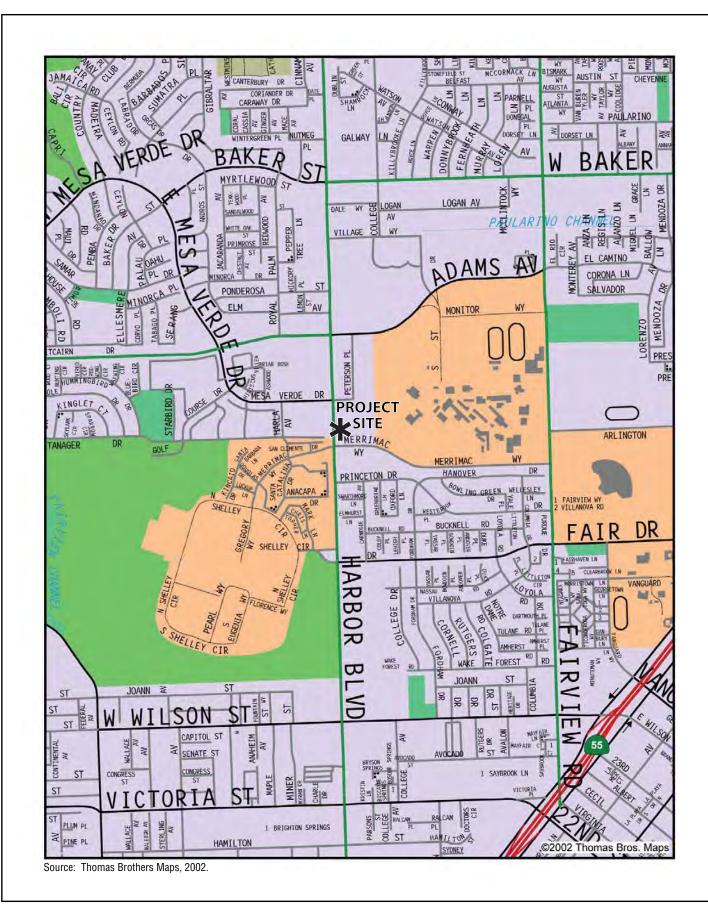






2626 HARBOR BOULEVARD INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

Exhibit 2: Local Vicinity Map



NOT TO SCALE



2626 HARBOR BOULEVARD INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

2 EXISTING CONDITION

This section is divided into three sub-sections: 1) existing land use; 2) hydrology; and 3) floodplains. Each sub-section describes different aspects of the existing condition of the project site.

2.1 Existing Land Use

The project site was formerly a Lincoln Mercury car dealership. Two vacant structures associated with the previous auto dealership are located on the project site. The site is comprised entirely of impervious surfaces primarily associated with the former dealership's parking lot. The project site is largely void of vegetation with the exception of a few ornamental trees along the Harbor Boulevard frontage and along the project site's western boundary.

Commercial uses (car dealerships) and a two-story multi-family housing development are located along the project site's northern boundary. Car ports and associated parking from these uses immediately abut the project. East of the project site is a three-story multi-family residential use. The development and associated surface parking, including carports, immediately abut the project.

Merrimac Way borders the project site to the immediate south. Beyond Merrimac Way is an auto dealership with associated mechanics facilities and surface parking. Multi-family residential uses with associated surface parking are also located to the south beyond Merrimac Way. Harbor Boulevard bounds the project site to the west. Beyond Harbor Boulevard is a multi-family residential development as well as Local Business (C1) uses.

For the existing hydrology condition analysis, the project site was considered commercial land use with a percent impervious of 90%.

2.2 Hydrology

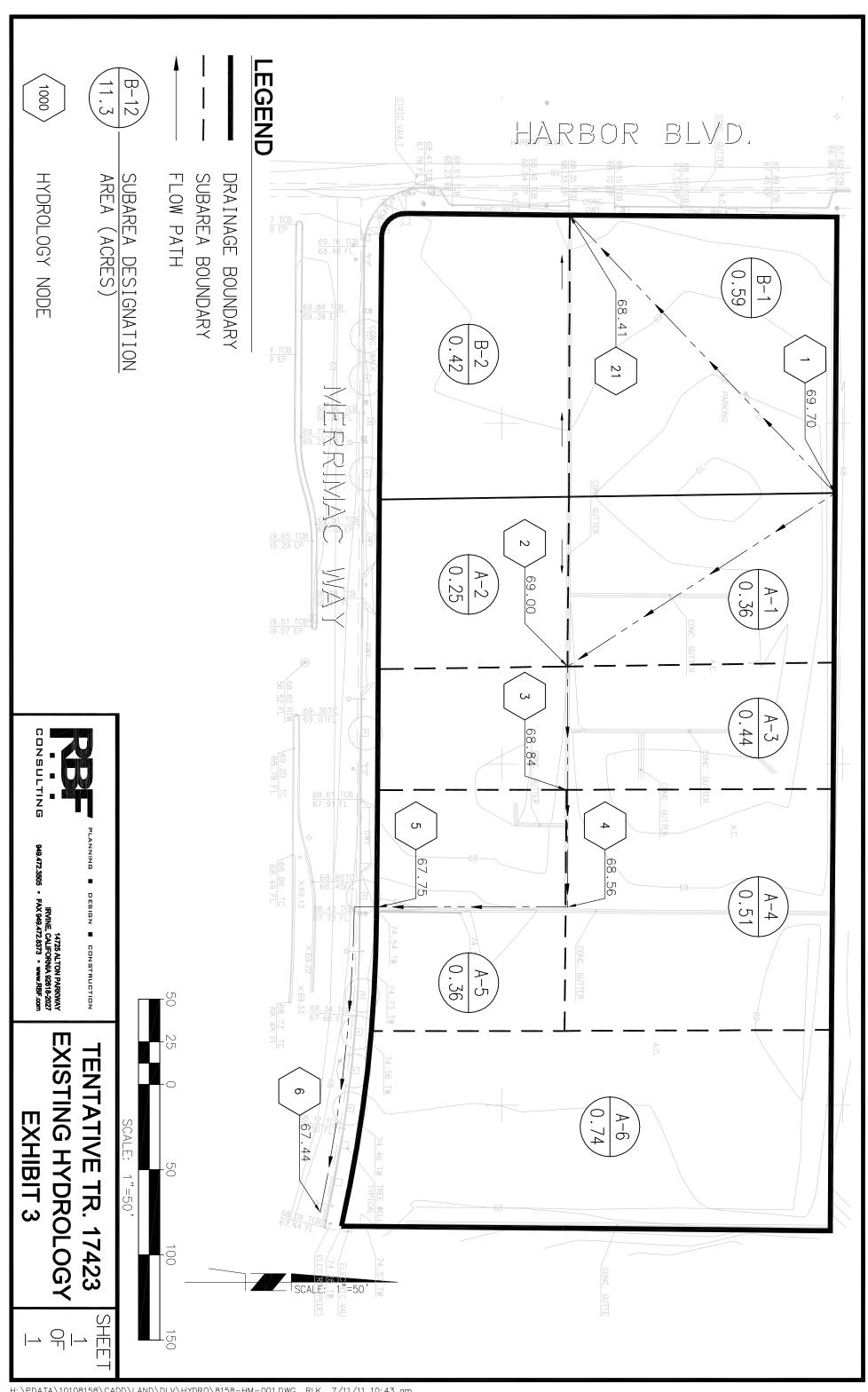
This sub-section describes the existing condition technical analysis. The sub-section is broken into two parts: Watershed Description and Analysis and Results.

2.2.1 Watershed Description

The existing watershed is broken up into two sub-watersheds: the area draining to Harbor Boulevard and the area draining to Merrimac Way, refer to Exhibit 3: Existing Conditions Hydrology Map. The runoff tributary to Harbor Boulevard (Watershed B) sheet flows from the parking lot to a driveway which outlets the flow onto Harbor Boulevard which eventually makes its way northeastword to F03 (Paularino Channel) which is eventually tributary to the Santa Ana Delhi Channel.

The runoff tributary to Merrimac sheet flows into a ribbon gutter, which eventually discharges to Merrimac Way through a driveway. The flow then continues eastward on Merrimac Way until it enters a catch basin which is tributary to an existing 4.5'Hx8'W RCB. The RCB is eventually tributary to E03 upstream of Pinecreek Drive.

Exhibit 3: Existing Hydrology Map



2.2.2 Analysis and Results

For this study, the existing site was delineated based on the topography. The areas were calculated and a rational method hydrology analysis was completed in accordance with Orange County Hydrology Manual Requirements. See Table 2-1 for Existing Condition Results.

Table 2-1: Existing Condition Hydrology Summary

Sub-		Area	Total 10-Year Flow Rate Exiting the Site	Total 25-Year Flow Rate Exiting the Site	Total 100-Year Flow Rate Exiting the Site
Watershed	Node	(acres)	(cfs)	(cfs)	(cfs)
Α	6	2.67	6.12	7.37	9.53
В	21	1.01	2.78	3.48	4.46

For the water quality Hydrologic Conditions of Concern Analysis, a 2-year storm was analyzed for runoff flowrate, volume and time of concentration for the overall site.

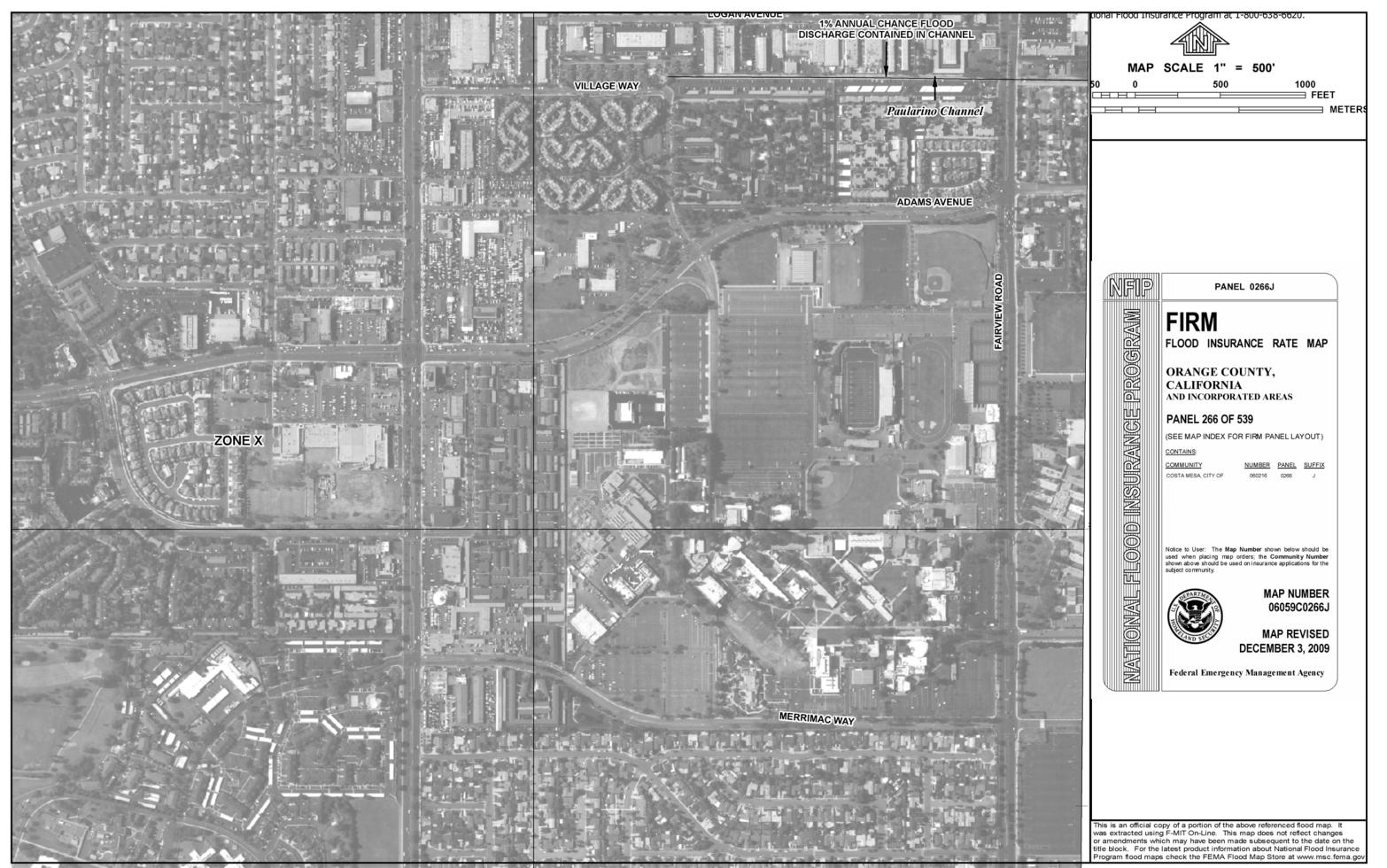
Table 2-2: Existing Condition 2-Year Analysis Summary

Flowrate (cfs)	Volume (Acre-feet)	Time of Concentration (Minutes)
4.82	0.45	11.72

2.3 Floodplains

The published Flood Insurance Rate Maps (FIRMs) for the project site are included on Community Panel No. 06059C0266J. Refer to Exhibit 4: FEMA FIRM Map, for a location of mapped floodplains. The project is located within the FEMA Zone X (Other Flood Areas) designation. FEMA Flood Zone X (Other Flood Areas) designated areas are outside of the 0.2% annual chance floodplain. FEMA Flood Zone X is a moderate to low risk flooding area where flood insurance is available to property owners but not required.

Exhibit 4: FEMA FIRM Map



3 PROPOSED CONDITIONS

This section describes the proposed condition technical analysis. The section is broken into three sub-sections: 1) proposed land use; 2) hydrology; and 3) floodplains. Each sub-section describes different aspects of the proposed condition.

3.1 Proposed Land Use

For the proposed condition, the project site was considered one land use: 8-10 dwelling units per acres. The percent impervious for each land use was per the *County of Los Orange Hydrology Manual*; refer to Exhibit 5: Proposed Conditions Hydrology Map and Table 3-1: Proposed Land Use Summary.

Table 3-1: Proposed Land Use Summary

		To	otal Area
Sub- Watershed	Node	(ac)	% Impervious
С	50	3.6	60%

3.2 Hydrology

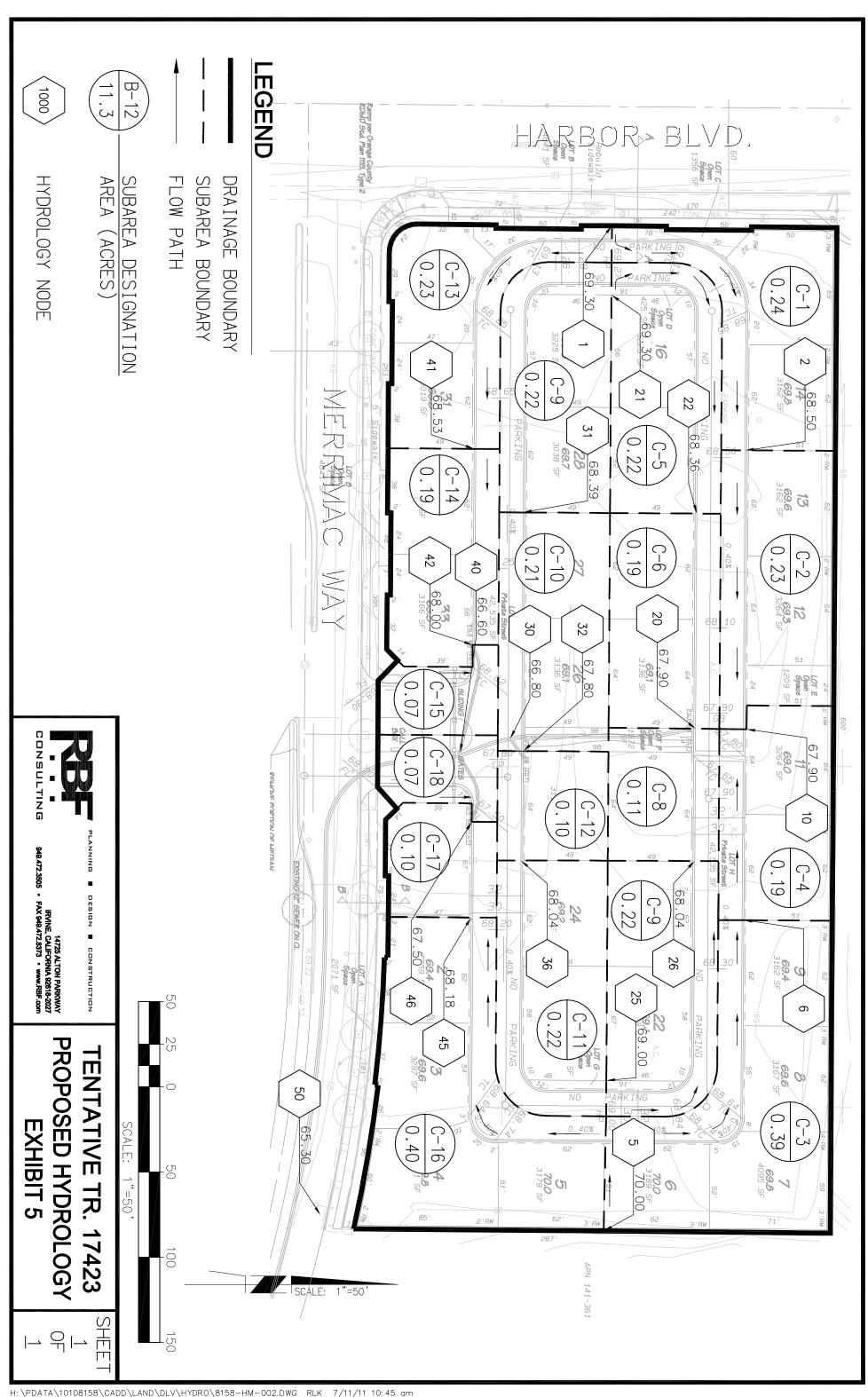
This sub-section is divided into two parts: 1) Watershed Description and 2) Analysis and Results.

3.2.1 Watershed Description

The proposed watershed is one Sub-watershed that is tributary to a new proposed storm drain pipe that will connect the new onsite storm drain directly to the existing 4.5'Hx8'W box under Merrimac Way (existing discharge point of Existing Condition Watershed A). The watershed tributary to the existing 4.5'Hx8'W box has increased slightly due to the combination of the existing Watershed A and B in the proposed condition (Watershed C). However, the percent impervious has been reduced from 90% to 60%.

The onsite storm drain consists of gutters, catch basins and storm drain to capture the development flow and direct it to the new storm drain extension in Merrimac Way.

Exhibit 5: Proposed Condition Hydrology Map



3.2.2 Analysis and Results

A proposed conditions hydrology analysis was completed for the 10-, 25-, and 100-year storms for comparison against existing conditions. The proposed condition hydrology was calculated using the Orange County Rational Method Hydrology; refer to Table 3-2: Proposed Hydrology Analysis Summary.

Table 3-2: Proposed Hydrology Analysis Summary

Sub-		Area	Total 10-year Flow Rate	Total 25-year Flow Rate	Total 100-year Flowrate
Watershed	Node	(acres)	(cfs)	(cfs)	(cfs)
С	50	3.60	8.16	9.83	12.68

For the water quality Hydrologic Conditions of Concern Analysis, a 2-year storm was analyzed for runoff flowrate, volume and time of concentration for the overall site.

Table 3-1: Proposed Condition 2-Year Analysis Summary

Flowrate (cfs)	Volume (Acre-feet)	Time of Concentration (Minutes)
4.34	0.27	12.53

3.3 Floodplains

Since the project area is in a Zone X floodplain, which is not a special flood hazard area, no changes to the floodplain will occur as part of the proposed project.

4 IMPACTS

This section describes the proposed condition impact to the watershed. The section is broken into four sub-sections: 1) drainage; 2) hydrology: and 3) floodplains. Each sub-section describes the different impacts caused by the proposed condition.

4.1 Drainage

The proposed project would alter drainage patterns due to on-site grading; refer to Table 4-1: Comparison of Drainage Area Impacts.

Table 4-1: Comparison of Drainage Area Impacts

Sub-	Existing	Conditions	Proposed	l Conditions	Comparison	
Watershed	Area	%	Area	%	∆ Area	Δ
	(ac)	Impervious	(ac)	Impervious	(ac)	%Impervious
A/C	2.67	90	3.68	60	1.07	-30%
В	1.01	90	0	0	-1.07	

4.2 Hydrology

The results of the impact analysis show that the change in drainage patterns onsite have caused a minor increase in flow to the proposed storm drain in Merrimac. However, overall the flow from the site is decreased to the Paularino Channel. Table 4-2: Comparison of Hydrology shows the results.

Table 4-2: Comparison Hydrology

Sub-	10-Year S	torm		25-Year S	torm		100-Year	Storm	
Watershed	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	∆ Flowrate	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	∆ Flowrate	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	Δ Flowrate
A/C	6.12	8.16	+2.04	7.37	9.83	+2.46	9.53	12.68	+3.15
В	2.78	0	-2.78	3.48	0	-3.46	4.46	0	-4.46
Total	8.90	8.16	-0.74	10.85	9.83	-1.0	13.99	12.68	-1.31

The results of the 2-year impact analysis show decreases in flowrate and volume, with an increase in Time of Concentration. The proposed land use would bring the hydrology of the 3.68 acres closer to a natural condition due to the increase in pervious area. The impacts of this change on the Santa Ana Delhi will be negligible as the project only represents 0.033% (3.68/11,071 acres) of the watershed.

Table 4-3: 2-year Comparison Hydrology

Parameter	Existing	Proposed	Δ
Flowrate (cfs)	4.82	4.34	-0.48
Volume (acre-feet)	0.45	0.27	0.18
Time of Concentration (min)	11.72	12.53	+0.81

4.3 Floodplains

There are no mapped special flood hazard areas on-site; therefore, there is no impact.

5 PROPOSED MITIGATION

This section describes the mitigation measures required to prevent the proposed project impacts to the watershed. The section is broken into four sub-sections: 1) drainage; 2) hydrology; and 3) floodplains.

5.1 Drainage

Mitigation measures for drainage are listed below:

- Prepare a detailed hydrology study to accurately identify project impacts.
- A new storm drain between the project site and the existing 4.5'H x8W RCB shall be analyzed, designed and constructed.
- All storm drain facilities shall be designed for 25-year storm event protection.
- All storm drain in public right-of-way shall be a minimum of 24 inches by City of Costa Mesa requirements and will be designed in accordance with the Orange County Local Drainage Manual including a minimum spacing between manholes of 300 feet.

Completion of these drainage mitigation measures would reduce impacts to a less than significant level.

5.2 Hydrology

Refer to mitigation measures outlines in Section 5.1. Completion of these mitigation measures would reduce flooding impacts to less than significant level.

5.3 Floodplain

No mitigation is required.

6 REFERENCES

Orange County Department of Public Works. Orange County Hydrology Manual. October 1986.

County of Orange. *Hydrology Report Santa Ana-Delhi Channel - Facility F01Entire Draiange System.* January 1996.

APPENDIX A: EXISTING CONDITION 10-, 25- AND 100-YEAR ANALYSIS

File name: EX-A-10.RES Date: 06/09/11 **********************

Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-A-10.DAT

TIME/DATE OF STUDY: 15:37 06/09/2011

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 USER SPECIFIED STORM EVENT(YEAR) = 10.00 SPECIFIED MINIMUM PIPPE SIZE(INCH) = 18.00 *DATA BANK RAINFALL USED*

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

2.00 0.0312 0.167 0.0150 (n *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* HIKE CURB GUTTER-GEOMETRIES: (FT) (FT) IN- / OUT-/PARK- HEIGHT WIDTH LIP (FT 0.67 (FI) STREET-CROSSFALL: 0.020/0.020/0.020 SIDE / SIDE/ WAY WIDTH CROSSFALL HALF- CROWN TO 10.0 (FI) 1 30.0

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FBET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) 2. (Depth) * (Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
D 0.36 0.20 0.10 75 7.48 ******************* 69.00 2.00 IS CODE = 21 69.70 DOWNSTREAM(FEET) = 1.04 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< COMMERCIAL D 0.36 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 0.36 PEAK FLOW RATE(CFS) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< 7.484 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 7.48
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.222 ξb INITIAL SUBAREA FLOW-LENGTH (FEET) = 185.00 1.00 TO NODE AREA SUBAREA IC AND LOSS RATE DATA(AMC II): ELEVATION DATA: UPSTREAM(FEET) = SCS SOIL 1,04 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/

File name: EX-A-10.RES

Page 1

Page 2

************************* UPSTREAM NODE ELEVATION (FEET) = 69.00 AVERAGE FLOW DEPTH (FEET) = 0.62 FLOOD WIDTH (FEET) = 3.00

"V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.41 TC (MIN.) = 7.89

SUBAREA AREA/ACRES) = 0.44 SUBAREA RUNOFF (CFS) = 1.24

EFFECTIVE AREA(ACRES) = 1.05 AREA-AVERAGED FM (INCH/HR) = 0.00

TOTAL AREA (ACRES) = 1.05 PEAK FLOW RATE (CFS) = 2.95 Ü 2.00 TO NODE 2.00 IS CODE = 81 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 91 (ACRES) (INCH/HR) (DECIMAL) GROUP (ACRES) (INCH/HR) (DECIMAL) TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 2.65 0.10 0.10 GUTTER HIKE (FEET) = 0.250 2.38 >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA< COMMERCIAL

COMMERCIAL

COMBARBA AVERAGE PERVIOUS LOSS RATE, FPI(INCH/HR) = 0.20
SUBARBA AVERAGE PERVIOUS ARRA FRACTION, Ap = 0.10
SUBARBA ARRA (ACRES) = 0.25
SUBARBA RENOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = 0.10 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 PAVEMENT LIP(FEET) = 0.375 MANNING'S N = .0150 TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = MAXIMUM DEPTH(FEET) = 0.70 * 10 YEAR RAINPALL INTENSITY(INCH/HR) = 3.143 MAINLINE TC(MIN) = 7.48 * 10 YEAR RAINPALL INTENSITY(INCH/HR) = 3.225 PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000 DOWNSTREAM NODE ELEVATION(FEET) = 68.84 CHANNEL LENGTH THRU SUBAREA(FEET) = 65.00 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA 0.44 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA DOWNSTREAM NODE ELEVATION (FEET) = 3.00 GROUP "V" GUTTER WIDTH (FEET) = FLOW PROCESS FROM NODE LAND USE LAND USE

DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP] NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL

FLOW VELOCITY (FEET/SEC.) = 2.65 DEPTH*VELOCITY (FT*FT/SEC) = 3.00 = FLOOD WIDTH (FEET) = 3.00 1.00 TO NODE END OF SUBAREA "V" GUTTER HYDRAULICS: LONGEST FLOWPATH FROM NODE DEPTH(FEET) = 0.62

ELEVATION DATA: UPSTREAM(FEET) = 68.84 DOWNSTREAM(FEET) = 68.56 CHANNEL SLOPE = 0.0040 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 51 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT) <<<<< 6.000 70.00 0.00 "Z" FACTOR = >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW< CHANNEL LENGTH THRU SUBAREA (FEET) = CHANNEL BASE (FEET) =

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) =

Date: 06/09/11

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SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.51 SUBAREA RUNOFF(CFS) =
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AREA_auprox--
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                                                                                                                                                                                                                                                                                                                                                                                                                                                        TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.72
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.58
AVERAGE FLOW DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Subarea average pervious loss rate, Fp(inch/hr) = 0.20 subarea average pervious area fraction, Ap = 0.10
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DEVELOPMENT TYPE/ SCS SOIL
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                       >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
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                                                                                                                                                                                                                                                                                                                                                                                                                                "V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.40 TC (MIN.) = 8.80
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        "V" GUTTER WIDTH (FEET) =
>>>> (STREET TABLE SECTION # 1 USED) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.966
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.044
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         LAND USE
                                                                                                                                                                                                                                                               DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]
                                                                                                                                                                                                                                                                                      NOTE: TRAVEL TIME ESTIMATES BASED ON NORMAL
                                                                                                                                                                                                                                                                                                                                       1.92
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    1.56
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           AMC II):
SCS SOIL AREA
                                                                                                                                                                                                                                                                                                                                                                                                           0.36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              4.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                 1.92
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        3.00
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                                                                   5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 1.56
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     MANNING'S N = .0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.00 TO NODE
                                                                                                                                          1.00 TO NODE 5.00 = 430.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          GUTTER HIKE (FEET) = 0.250
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              68.56
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AREA-AVERAGED Fm(INCH/HR) = 0.02
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.51
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.36
                                                                                                                                                                                                                                                                                                                                       PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                    AREA-AVERAGED Fm(INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              2.95
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                                                                                                                                                                                             3.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              5.00 IS CODE = 91
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Ğ
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                                                                      6.00 IS CODE = 62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     4.00 = 320.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.46
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Αp
                                                                                                                                                                                                                                                                                                                                                               0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           1.39
                                                                                                                                                                                                                                                                                                                                                                                                           0.95
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28
                                                                                                                                                                                                                                                                                                                                       5.09
                                                                                                                                                                                                                                                                                                                                                                                    0.02
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SUBAREA LOSS RATE DATA (AMC DEVELOPMENT TYPE/ SCS Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.019 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020 STREET HALFWIDTH (FEET) = 30.00 STREET LENGTH (FEET) = 195.00 CURB HEIGHT (INCHES) = 8.0 UPSTREAM ELEVATION(FEET) = 67.75 DOWNSTREAM ELEVATION(FEET) = 67.44 EFFECTIVE AREA(ACRES) = 0.74
AREA-AVERACES SUBAREA LOSS RATE DATA (AMC DEVELOPMENT TYPE/ SCS SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
SUBAREA AREA(ACRES) = 0.01 SUBAREA RUNOFF(CFS) = STREET FLOW TRAVEL TIME (MIN.) = 2.45 STREET PARKWAY CROSSFALL (DECIMAL) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 EFFECTIVE AREA(ACRES) = TOTAL AREA (ACRES) END OF STUDY SUMMARY: TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = 2.67 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 COMMERCIAL MAINLINE Tc(MIN) = 11.25 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE FLOW VELOCITY (FEET/SEC.) = 1.32 DEPTH*VELOCITY (FT*FT/SEC.) = DEPTH(FEET) = 0.54 END OF SUBAREA STREET FLOW HYDRAULICS: NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE Area-averaged Fp (Inch/hr) = 0.20 Area-averaged Ap = 0.10 Total Area(Acres) = 1.93 Peak flow rate(CFS) = EFFECTIVE AREA(ACRES) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20 COMMERCIAL INSIDE STREET CROSSFALL (DECIMAL) = 0.020 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 10.00 PEAK FLOW RATE (CFS) = AREA-AVERAGED Fp(INCH/HR) = 0.20AVERAGE FLOW VELOCITY (FEET/SEC.) = HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW DEPTH(FEET) = 0.54 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.565 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.565 LAND USE LAND USE HALFSTREET FLOOD WIDTH (FEET) = 19.12 0.01 2.67 SCS SOIL GROUP SCS SOIL GROUP 1.93 U U 6.00 TO NODE II): 2.67 6.12 2.67 1.00 TO NODE (ACRES) (INCH/HR) (DECIMAL) (ACRES) (INCH/HR) (DECIMAL) AREA AREA 19.12 AREA-AVERAGED Ap = 0.10 PEAK FLOW RATE (CFS) = SUBAREA RUNOFF (CFS) = AREA-AVERAGED Fm(INCH/HR) = AREA-AVERAGED Fm(INCH/HR)= 0.02 TC(MIN.) = 0.01 0.74 1.33 Tc(MIN.) = 11.250.72 ďΞ Ţ 6.00 IS CODE = 81 0.10 0.20 0.20 6.00 = 625.00 FEET. 0.10 0.10 Ą 0.0199 0.02 6.12 5.09 0.02 Q CN 0.72 0.0150

Page 6 File name: EX-A-10.RES Date: 06/09/11

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Date: 06/09/11 File name: EX-A-10.RES	ONAL METHOD ANALY			

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File name: EX-B-10.RES Date: 06/07/11

Page 1

******************** Copyright 1983-2001 Advanced Engineering Software (aes) RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION) (C)

Analysis prepared by:

Ver. 8.0 Release Date: 01/01/2001 License ID 1264

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-B-10.DAT --*TIME-OF-CONCENTRATION MODEL *--TIME/DATE OF STUDY: 08:57 06/07/2011

USER SPECIFIED STORM EVENT(YEAR) = 10.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD* *DATA BANK RAINFALL USED*

END OF RATIONAL METHOD ANALYSIS

CURB GUTTER-GEOMETRIES: MANNING HEIGHT WIDTH LIP HIKE FACTOR HACKBER BEREIT BEREIT 2.00 0.0312 0.167 0.0150 Ē *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* (FT) (FI) (FT) 11 11 11 11 11 0.67 (FI) STREET-CROSSFALL: 0.018/0.018/0.020 / OUT-/PARK-SIDE / SIDE/ WAY 'n HALF- CROWN TO WIDTH CROSSFALL 20.0 (FT) 1 30.0 (FT) o Q

1. Relative Flow-Depth = 0.00 FEBT as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED 2. (Depth)(Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

(MIM) 68.41 g SCS (ACRES) (INCH/HR) (DECIMAL) CN 21.00 IS CODE = 21 69.20 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Αp COMMERCIAL D 0.59 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, $\rm Pp\,(INCH/HR)\,=\,0.20$ SUBAREA AVERAGE PERVIOUS AREA FRACTION, $\rm Ap\,=\,0.10$ PEAK FLOW RATE (CFS) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 8.216 ц SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 8.21
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.054 225.00 1.00 TO NODE AREA SUBAREA TC AND LOSS RATE DATA (AMC II); INITIAL SUBAREA FLOW-LENGTH(FEET) = SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = GROUP 1.61 0.59 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) == rotal area (acres) = DEVELOPMENT TYPE/

1.61

Page 2 AREA-AVERAGED Fm(INCH/HR) = 0.02 2.78 CN 1.16 21.00 IS CODE = 81 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) AREA-AVERAGED Fm(INCH/HR)= 0.10 EFFECTIVE AREA(ACRES) = 1.01 AREA-AVERAGED Fm(INCH/HR) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 AREA-AVERAGED Ap = 0.10 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.42 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< File name: EX-B-10.RES 0.20 MAINLINE TC(MIN) = 8.22 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.080 TC(MIN.) = 21.00 TO NODE 0.42 TOTAL AREA(ACRES) = 1.01

EFFECTIVE AREA(ACRES) = 1.01

AREA-ARRAGED FD (INCH/HR) = 0.20

PEAK FLOW RATE (CFS) = 2.78 SUBAREA LOSS RATE DATA(AMC II); DEVELOPMENT TYPE/ SCS SOIL GROUP Ω 1.01 FLOW PROCESS FROM NODE END OF STUDY SUMMARY: TOTAL AREA (ACRES) = LAND USE Date: 06/07/11

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Date: 06/09/11

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File name: EX-A-25.RES

Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-A-25.DAT

TIME/DATE OF STUDY: 15:40 06/09/2011

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL *--

USER SPECIFIED STORM EVENT(YEAR) = 25.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD* *DATA BANK RAINFALL USED*

2.00 0.0312 0.167 0.0150 £ *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* CURB GUTTER-GEOMETRIES: (FT) (FI) HEIGHT WIDTH LIP (FT) 0.67 (FT) STREET-CROSSFALL: IN- / OUT-/PARK-0.020/0.020/0.020 SIDE / SIDE/ WAY WIDTH CROSSFALL HALF- CROWN TO 10.0 (FI) 1 30.0

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FBET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

(Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

2.00 IS CODE = 21 1.00 TO NODE FLOW PROCESS FROM NODE

69.00 69.70 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< INITIAL SUBAREA FLOW-LENGTH (FEET) = 185.00 ELEVATION DATA: UPSTREAM(FEET) =

Ap TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 7.484 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.839 ΨĎ SUBAREA TC AND LOSS RATE DATA(AMC II): AREA SCS SOIL DEVELOPMENT TYPE/

COMMERCIAL D 0.36 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 1.24 SUBAREA RUNOFF(CFS) =

1.24

0.36 PEAK FLOW RATE(CFS) =

TOTAL AREA (ACRES) =

(MIM.)

 $\label{eq:effective_area} EFFECTIVE AREA-(ACRES) = 0.61 & AREA-AVERAGED Fm(INCH/HR) = 0.02 & AREA-AVERAGED Ap = 0.10 & A$ S 2.00 IS CODE = 81 (ACRES) (INCH/HR) (DECIMAL) 0.10 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.25 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.836 2.00 TO NODE 0.25 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL GROUP Д 0.61 MAINLINE TC(MIN) = 7.48 FLOW PROCESS FROM NODE TOTAL AREA(ACRES) = LAND USE

3.00 IS CODE = 91 2.00 TO NODE FLOW PROCESS FROM NODE

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<< UPSTREAM NODE ELEVATION(FEET) =

GUTTER HIKE (FEET) = 0.250 "V" GUTTER WIDTH (FEET) = 3.00 GUTTER HIKE (FEET) PAVEMENT LIP (FEET) = 0.375 MANNING'S N = .0150 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.740 PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000 65.00 68.84 69.00 CHANNEL LENGTH THRU SUBAREA (FEET) = DOWNSTREAM NODE ELEVATION (FEET) = 0.70 "V" GUTTER WIDTH (FEET) = MAXIMUM DEPTH(FEET) =

AREA-AVERAGED Fm(INCH/HR) = 0.02 S 1.47 TRAVEL TIME COMPUTED USING ESTINATED FLOW(CFS) = 2.83
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FREET/SEC.) = 2.65
AVERAGE FLOW DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00 (ACRES) (INCH/HR) (DECIMAL) "V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.41 TC(MIN.) = 7.89 EFPECTIVE AREA (ACRES) = 1.05 AREA-AVERAGED FM(INCH/HR) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 0.10 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 0.20 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA 0.44 GROUP 0.44 Ω 1.05 SUBAREA AREA (ACRES) = TOTAL AREA (ACRES) = LAND USE

DEPTH EQUAL TO [GUITTER-HIKE + PAVEMENT LIP] NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL

DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00
FLOW VELOCITY(FREET/SEC.) = 2.65 DEPTH*VELOCITY(FT*FT/SEC) = LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 250.00 3.00 = 1.00 TO NODE END OF SUBAREA "V" GUTTER HYDRAULICS:

4.00 IS CODE = 51 3.00 TO NODE FLOW PROCESS FROM NODE

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT) <<<<< >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<

68.56 CHANNEL SLOPE = 0.0040 68.84 DOWNSTREAM(FEET) = 6.000 00 "Z" FACTOR = 6.000 MAXIMUM DEPTH(FEET) = 70.00 ELEVATION DATA: UPSTREAM(FEET) = CHANNEL LENGTH THRU SUBAREA(FEET) = CHANNEL BASE(FEET) = 0.00 "Z" FA MANNING'S FACTOR = 0.015

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SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     CHANNEL FLOW THRU SUBAREA (CFS) =
                                                                                                                                                                                                                                                                                                                             EFFECTIVE AREA(ACRES) = 1.92 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 1.92 PEAK FLOW RATE(CFS) = 6.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           EFFECTIVE AREA(ACRES) = 1.56 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                MAINLINE Tc(MIN) = 8.37
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       FLOW VELOCITY (FEET/SEC) = 2.43
                                                                                                                                                                                                                                                                                                                                                                                                                                                             TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.64
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.58
AVERAGE FLOW DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SUBAREA LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.250 PAVEMENT LIP(FEET) = 0.375 MANNING'S N = .0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CHANNEL LENGTH THRU SUBAREA (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DOWNSTREAM NODE ELEVATION (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 91
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA AREA(ACRES) = 0.51
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                               FLOW PROCESS FROM NODE
                                                                                                                             LONGEST FLOWPATH FROM NODE
                                                                                                                                              END OF SUBAREA "V" GUTTER HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          MAXIMUM DEPTH(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                UPSTREAM NODE ELEVATION(FEET) = 68.56
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                      "V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.40 Tc (MIN.) = 8.77
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.631
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.540
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            LAND USE
                                                                                                                                                                                                                                                                              NOTE: TRAVEL TIME ESTIMATES BASED ON NORMAL
                                                                                                                                                                                                                                                       DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.48
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            0.70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.56
                                                                                                                                                                                                                                                                                                                                                                                                             0.36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   GROUP
                                             5.00 TO NODE 6.00 IS CODE = 62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 4.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                (ACRES) (INCH/HR) (DECIMAL)
0.51 0.20 0.10
                                                                                                                             1.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (ACRES) (INCH/HR) (DECIMAL)
0.36 0.20 0.70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            FLOW DEPTH(FEET) = 0.49
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     AREA
                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         110.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  67.75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       3.52
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 4.00 IS CODE = 81
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Ŧρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Fρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          4.00 = 320.00 FEET
                                                                                                                             5.00 = 430.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Αp
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Αp
                                                                                                                                                                                                                                                                                                                                                                                                             1.14
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ) QN
75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               5.07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     75
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>>>> (STREET TABLE SECTION # 1 USED) <<<<<

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AREA-AVERAGED Fp(INCH/HR) = 0.02

TOTAL AREA(ACRES) = 1.93

PEAK ET ON PROFILE 1.93

PEAK ET ON PROFILE 1.93

NOTE: DEAK TON PROFILE 1.93
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     STREET HALFWIDTH (FEET) = 30.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            STREET LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     UPSTREAM ELEVATION(FEET) = 67.75 DOWNSTREAM ELEVATION(FEET) =
                                                                                                                                                       2.04

AREA-AVERAGED FM (INCH/HR) = 0.02

TOTAL AREA(ACRES) = 2.67

PEAK FIAM DAMP (ACRES) = 2.67

PEAK FIAM DAMP (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      INSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                           SUBAREA AREA(ACRES) = 0.74
EFFECTIVE AREA(ACRES) = 2.
                                                                                                                                                                                                                                                                                                                                                                                SUBAREA LOSS RATE DATA (AMC DEVELOPMENT TYPE/ SCS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  DEPTH(FEET) = 0.57 HALFSTREET FLOOD WIDTH(FEET) = 20.51 FLOW VELOCITY(FEET/SEC.) = 1.38 DEPTH*VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    COMMERCIAL
                      TOTAL AREA(ACRES) = 2.67
EFFECTIVE AREA(ACRES) = 2.67
AREA-AVERAGED FP(INCH/HR) = 0.20
PEAK FLOW RATE(CFS) = 7.37
                                                                                                                            END OF STUDY SUMMARY:
                                                                                                                                                                                                                                                    SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
SUBAREA AREA (ACRES) = 0.74
SUBAREA RUNOFF (CFS) =
                                                                                                                                                                                                                                                                                                        SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                      COMMERCIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                MAINLINE Tc(MIN) = 11.12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.086
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STREET FLOW DEPTH(FEET) = 0.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                    25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.086
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               LAND USE
                                                                                                                                                                                                                                                                                                                                                            LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              195.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                     SCS SOIL
                                                                                                                                                                                                                                                                                                                                                            GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      U
                                                                                                                                                                                                                                                                                                                                      U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 6.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                         II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CURB HEIGHT (INCHES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (ACRES) (INCH/HR) (DECIMAL)
0.01 0.20 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                2.34
                                                                                                                                                                                                                                                                                                                                                          (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           20.51
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA
                                                                                                   TC(MIN.) =
                                                 AREA-AVERAGED Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                     AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SUBAREA RUNOFF(CFS) =
                                                                          AREA-AVERAGED Fm(INCH/HR)=
                                                                                                                                                                                                                                                                                                                                   0.74
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  1.39
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Tc(MIN.) = 11.12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.79
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Ε̈́р
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 6.00 IS CODE = 81
                                                                                                                                                                                                                                                                                                                                                                                   Ε̈́ρ
                                                                                                                                                                                                                                                                                                                                   0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            6.00 = 625.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              8.0
                                                                                                                                                                                                                                                                                                                                      0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Αp
                                                                                                                                                                                                                                                                                                                                                                                   Α̈́ρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        6.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          CN
                                                                                                                                                                                                                                                                                                                                                          CN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          67.44
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Page 6 File name: EX-A-25.RES Date: 06/09/11

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Date: 06/09/11 Rile name. Ex.a.or pro	ONAL METHOD ANALYS					•		
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Date: 06/07/11

File name: EX-B-25.RES

Page 1

Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-B-25.DAT --*TIME-OF-CONCENTRATION MODEL*--TIME/DATE OF STUDY: 08:59 06/07/2011

USER SPECIFIED STORM EVENT (YEAR) = 25.00

SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD *DATA BANK RAINFALL USED*

 CURB
 GUTTER-GEOMETRIES:
 MANNING

 HEIGHT
 WIDTH
 LIP
 HIKE
 PACTOR

 (FT)
 (FT)
 (FT)
 (n)
 2.00 0.0312 0.167 0.0150 *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* 0.67 STREET-CROSSFALL: 0.018/0.018/0.020 / OUT-/PARK-SIDE / SIDE/ WAY -NI HALF- CROWN TO WIDTH CROSSFALL 11 12 13 14 14 14 14 11 20.0 (FI) 1 30.0 (FT) . 00

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth) * (Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

21.00 IS CODE = 21 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< 1.00 TO NODE FLOW PROCESS FROM NODE

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

68.41 69.70 DOWNSTREAM(FEET) = INITIAL SUBAREA FLOW-LENGTH(FEET) = 225.00 ELEVATION DATA: UPSTREAM(FEET) =

TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANLYZEI USED MINIMOW! TC (MIN.) = 7.448 * 25 YEAR RAINFALL INTERSITY (INCH/HR) = 3.850 SUBAREA TC AND LOSS RATE DATA(AMC II):

(MIN.) SCS (ACRES) (INCH/HR) (DECIMAL) CN Ap COMMERCIAL D 0.59 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 F. AREA SCS SOIL GROUP DEVELOPMENT TYPE/ COMMERCIAL

2.03 SUBAREA RUNOFF(CFS) =

2.03 PEAK FLOW RATE(CFS) = 0.59 TOTAL AREA (ACRES) =

File name: EX-B-25.RES Date: 06/07/11

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************************** $EFECTIVE \ AREA-(ACRES) = 1.01 \quad AREA-AVERAGED \ Fm(INCH/HR) = 0.02 \quad AREA-AVERAGED \ APPROVED \ Pp (INCH/HR) = 0.20 \quad AREA-AVERAGED \ APPROVED \ APPRO$ 3.48 0.02 Ü 1.45 21.00 IS CODE = 81 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) TC (MIN.) = 7.45 AREA-AVERAGED FM (INCH/HR) = AREA-AVERAGED Ap = 0.10 0.10 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.42 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 MAINLINE TC(MIN) = 7.45 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.850 21.00 TO NODE 0.42 TOTAL AREA(ACRES) = 1.01
EFFECTIVE AREA(ACRES) = 1.01
AREA-AVERAGED Fp(INCH/HR) = 0.20 3.48 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL END OF RATIONAL METHOD ANALYSIS GROUP Ω 1.01 FLOW PROCESS FROM NODE EFFECTIVE AREA (ACRES) = END OF STUDY SUMMARY: TOTAL AREA (ACRES) = PEAK FLOW RATE (CFS) LAND USE

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Date: 06/09/11

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File name: EX-A-100.RES

Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-A-100.DAT TIME/DATE OF STUDY: 15:43 06/09/2011

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 USER SPECIFIED STORM EVENT(YEAR) = 100.00 *DATA BANK RAINFALL USED*

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

2.00 0.0312 0.167 0.0150 Ξ *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* CURB GUTTER-GEOMETRIES: (FT) (FI) HEIGHT WIDTH LIP (FT) 0.67 (FT) STREET-CROSSFALL: IN- / OUT-/PARK-0.020/0.020/0.020 SIDE / SIDE/ WAY WIDTH CROSSFALL HALF- CROWN TO (FT) 10.0 1 30.0 (FT

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) $\,$

 (Depth) * (Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN 2.00 IS CODE = 21 1.00 TO NODE

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

FLOW PROCESS FROM NODE

69.00 69.70 DOWNSTREAM (FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<< INITIAL SUBAREA FLOW-LENGTH(FEET) = 185.00 ELEVATION DATA: UPSTREAM(FEET) =

(ACRES) (INCH/HR) (DECIMAL) CN 0.36 0.20 0.10 75 Αp TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 7.484 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.910 Fр AREA :(11 SUBAREA TC AND LOSS RATE DATA(AMC SCS SOIL GROUP Д DEVELOPMENT TYPE/

(MIM.)

SUBARBA AVERAGE PERVIOUS LOSS RATE, Pp(INCH/HR) = 0.20 SUBARBA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 PEAK FLOW RATE(CFS) = 1.58 0.36 SUBAREA RUNOFF(CFS) = FOTAL AREA (ACRES) =

 EFPECTIVE AREA(ACRES) =
 0.61
 AREA-AVERAGED Fm(INCH/HR) =
 0.02

 AREA-AVERAGED Pp (INCH/HR) =
 0.20
 AREA-AVERAGED Ap =
 0.10

 TOTAL AREA (ACRES) =
 0.61
 PEAK FLOW RATE (CFS) =
 2.68
 g 2.00 IS CODE = 81 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 0.10 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.25 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 MAINLINE TC(MIN) = 7.48 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.908 2.00 TO NODE 0.25 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL GROUP Ω FLOW PROCESS FROM NODE LAND USE

3.00 IS CODE = 91 2.00 TO NODE FLOW PROCESS FROM NODE

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<

GUTTER HIKE (FEET) = 0.250 "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) PAVEMENT LIP(FEET) = 0.375 MANNING'S N = .0150 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.784 PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000 65.00 68.84 69.00 CHANNEL LENGTH THRU SUBAREA(FEET) = DOWNSTREAM NODE ELEVATION (FEET) = UPSTREAM NODE ELEVATION (FEET) = MAXIMUM DEPTH(FEET) =

AREA-AVERAGED Fm(INCH/HR) = 0.02 SCS CN 75 1.89 "V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.41 TC (MIN.) = 7.89 SUBAREA AREA (ACRES) = 0.44 SUBAREA RUNOFF (CFS) = 1. (ACRES) (INCH/HR) (DECIMAL) TRAVEL TIME THRU SUBARBA BASED ON VELOCITY(FEET/SEC.) = 2.65 AVERAGE FLOW DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00 EFFECTIVE AREA (ACRES) = 1.05 AREA-AVERAGED FM (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.10 TOTAL AREA (ACRES) = 1.05 PEAK FLOW RATE (CFS) = 0.10 3.63 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 0.20 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA 0.44 GROUP LAND USE

3.00 = 250.00 FEET. FLOW VELOCITY(FEET/SEC.) = 2.59 DEPTH*VELOCITY(FT*FT/SEC) = FLOOD WIDTH (FEET) = 10.15 1.00 TO NODE END OF SUBAREA "V" GUTTER HYDRAULICS: LONGEST FLOWPATH FROM NODE DEPTH(FEET) = 0.66

4.00 IS CODE = 51 3.00 TO NODE FLOW PROCESS FROM NODE

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT) <<<<< >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<

68.84 DOWNSTREAM(FEET) = 68.5 70.00 CHANNEL SLOPE = 0.0040 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = "Z" FACTOR = CHANNEL LENGTH THRU SUBAREA (FEET) = ELEVATION DATA: UPSTREAM(FEET) = 0.00 CHANNEL BASE (FEET) =

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL CAPACITY (NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM

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ALLOWABLE DEPTH).
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.
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CHANNEL FLOW THRU SUBAREA(CFS) = 4.50
FLOW VELOCITY(FEET/SEC) = 3.00 FLOW DEPTH(FEET) = 0.50
TRAVEL TIME(MIN.) = 0.39 TC(MIN.) = 8.28

==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 320.00 FEET.

MAINLINE TC(MIN) = 8.28

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.668

SUBARRA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA FD

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Δp = 0.10 TOTAL AREA(ACRES) = 1.56 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 EFFECTIVE AREA(ACRES) = SUBAREA AREA(ACRES) = COMMERCIAL LAND USE 0.51 1.56 SCS SOIL GROUP (ACRES) (INCH/HR) (DECIMAL) CN 0.51 0.20 0.10 75 AREA AREA-AVERAGED Fm(INCH/HR) = 0.02PEAK FLOW RATE (CFS) = SUBAREA RUNOFF (CFS) = Ęρ Αp 6.53

MAXIMUM DEPTH (FEET) = 0.70

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.551

SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA FP

LAND USE GROUP (ACRES) (INCH/HR) (I

DEVELOPMENT TYPE/ SCS SOIL AREA FP AP SCS LAND USE GROUP (ACES) (INCH/HR) (DEIMAL) CN COMMERCIAL

COMMERCIAL

D 0.36 (INCH/HR) 0.20 0.10 75 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = 0.10 TRAVEL TIME COMPUTED USING RESTIMATED FLOW(GES) = 7.26

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET)/SEC.) = 4.62

AVERAGE FLOW DEPTH (FEET) = 0.64 FLOOD MIDTH (FEET) = 6.16

"V" GUTTER FLOW TRAVEL TIME (MIN.) = 0.40 TC (MIN.) = 8.68

SUBAREA AREA(ACRES) = 0.36 SUBAREA RUNOFF (CFS) = 1.47

EFFECTIVE AREA(ACRES) = 1.92 AREA-AVERAGED Fm(INCH/HR) = 0.02

AREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED Fm (INCH/HR) = 0.02

TOTAL AREA(ACRES) = 1.92 PEAK FLOW TAXATA OF
END OF SUBAREA "V" GUTTER HYDRAULICS:

DEPTH(FEET) = 0.66 FLOOD WIDTH(FEET) = 10.38

FLOW VELOCITY(FEET/SEC.) = 4.48 DEPTH*VELOCITY(FT*FT/SEC) =

FLOW VELOCITY(FEET/SEC.) = 4.48 DEPTH+VELOCITY(FT+FT/SEC) = 2.97 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 430.00 FEET.

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
***TDAUGI. TIME COMPUTED HISTOG ESTIMATED FLOW(CES) = 7.85

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = 0.10
SUBAREA AREA(ACRES) = 0.01
SUBAREA RUNOFF(CFS) = COMMERCIAL SUBAREA LOSS RATE DATA (AMC II): STREET FLOW TRAVEL TIME (MIN.) = 2.20 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.985 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 DEVELOPMENT TYPE/ PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = AVERAGE FLOW VELOCITY (FEET/SEC.) = HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW DEPTH(FEET) = 0.61 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = LAND USE 1.93 SCS SOIL GROUP 1.93 U (ACRES) (INCH/HR) (DECIMAL) AREA 22.62 PEAK FLOW RATE(CFS) = AREA-AVERAGED Fm(INCH/HR) = 0.02 0.01 1.48 Tc(MIN.) = 10.880.90 Ęρ 0.20 0.10 Αp 0.04 7.83 75 75

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.61 HALFSTREET FLOOD WIDTH(FEET) = 22.62

FLOW VELOCITY(FEET/SEC.) = 1.48 DEPTH*VELOCITY(FT*FT/SEC.) = 0.90

LONGEST FLOWDATH FROM NODE 1.00 TO NODE 6.00 = 625.00 FEET.

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<

MAINLINE TC (MIN) = 10.88

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.985 SUBAREA LOSS RATE DATA (AMC II):

SUBAREA AVERAGE PERVIOUS LOSS RATE, FD(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.74 SUBAREA RUNOFF(CFS) = TOTAL AREA(ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10 EFFECTIVE AREA(ACRES) = COMMERCIAL DEVELOPMENT TYPE/ LAND USE 2.67 SCS SOIL GROUP U 2.67 L AREA FP AP SCS
(ACRES) (INCH/HR) (DECIMAL) CN
0.74 0.20 0.10 75 PEAK FLOW RATE(CFS) = AREA-AVERAGED Fm(INCH/HR) = 0.02 0.74 SUBAREA RUNOFF(CFS) = 0.20 0.10 2.64 9.53

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 2.67 TC(MIN.) = 10.88EFFECTIVE AREA(ACRES) = 2.67 AREA-AVERAGED Fm(INCH/HR) = 0.02 Date: 06/09/11 File name: ECA-100-RES | Pose o

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

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Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-B-100.DAT "林州林北部四日间报报报的特殊的人特殊的目标的目标的目标和自己的目标和自己的目标的目标的和非常的目标的目标的目标的目标的目的目标的 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: TIME/DATE OF STUDY: 09:00 06/07/2011

SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 --*TIME-OF-CONCENTRATION MODEL*--USER SPECIFIED STORM EVENT (YEAR) = 100.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

DATA BANK RAINFALL USED

MANNING 0.67 2.00 0.0312 0.167 0.0150 FACTOR (n *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* WIDTH LIP HIKE CURB GUTTER-GEOMETRIES: (FT) (FT) (FT) / OUT-/PARK- HEIGHT (FT) STREET-CROSSFALL: 0.018/0.018/0.020 SIDE / SIDE/ WAY -NI WIDTH CROSSFALL 11 11 11 11 11 11 11 HALF- CROWN TO 20.0 (FT) 30.0 (FT) NO.

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

Relative Flow-Depth = 0.00 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE. *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

(MIN.) 68.41 D H 21.00 IS CODE = 21 69.70 DOWNSTREAM(FEET) = 0.10 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< COMMERCIAL D 0.59 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 7.448 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 7.44 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.924 INITIAL SUBAREA FLOW-LENGTH (FEET) = 225.00 1.00 TO NODE SUBAREA TC AND LOSS RATE DATA(AMC II): AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = 2.60 0.59 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/

2.60

Page 2 1.01 AREA-AVERAGED Fm(INCH/HR) = 0.02 0.02 4.46 S 21.00 TO NODE 21.00 IS CODE = 81 (ACRES) (INCH/HR) (DECIMAL) AREA-AVERAGED Fm(INCH/HR)= 0.10 AREA-AVERAGED P(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 1.01
PEAK FLOW RATE (CFS) = TOTAL AREA (ACRES) = 1.01 TC (MIN.) = 7.45

FRECTIVE AREA (ACRES) = 1.01 AREA-AVERAGED FW (INCH/HR)

AREA-AVERAGED FG (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10

PEAK FLOW RATE (CFS) = 4.46 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 SUBAREA AREA(ACRES) = 0.42 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 Fр MAINLINE TC(MIN) = 7.45 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.927 0.42 AREA SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL END OF RATIONAL METHOD ANALYSIS GROUP Д FLOW PROCESS FROM NODE EFFECTIVE AREA (ACRES) = END OF STUDY SUMMARY: LAND USE

APPENDIX B: PROPOSED CONDITION 10-, 25-, AND 100-YEAR ANALYSIS

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File name: PROP-10.RES

Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE (Reference: 1986 OCEMA HYDROLOGY CRITERION)

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\PROP-10.DAT TIME/DATE OF STUDY: 09:17 06/06/2011 USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD* *DATA BANK RAINFALL USED*

******* ****** ****** ***** 1.00 0.0312 0.080 0.0150 HIKE FACTOR *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* (n) CURB GUITER-GEOMETRIES: (FT) (FI) / OUT-/PARK- HEIGHT WIDTH LIP (FI) 0.40 (FI) STREET-CROSSFALL: 0.020/0.020/0.020 SIDE / SIDE/ WAY 'n HALF- CROWN TO WIDTH CROSSFALL 5.0 (FI) 1 15.0 NO.

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FBET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A PLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

********************** 2.00 IS CODE = 21 1.00 TO NODE FLOW PROCESS FROM NODE

(ACRES) (INCH/HR) (DECIMAL) CN (MIN.) 68.50 69.30 DOWNSTREAM(FEET) = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Αp "8-10 DWELLINGS/ACRE" D 0.24 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.167
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.868 INITIAL SUBAREA FLOW-LENGTH(FEET) = 192.00 SUBAREA TC AND LOSS RATE DATA(AMC II); AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = 0.60 GROUP SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/

09.0

PEAK FLOW RATE(CFS) =

0.24

TOTAL AREA (ACRES) =

**************************** 0.0150 UPSTREAM ELEVATION(FEET) = 68.50 DOWNSTREAM ELEVATION(FEET) = 67.90 AREA-AVERAGED Fm(INCH/HR) = 0.08 1.04 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 S 75 0.51 10.00 IS CODE = 62 (ACRES) (INCH/HR) (DECIMAL) 0.40 CURB HEIGHT (INCHES) = 4.8 Αp 5.00 STREET FLOW TRAVEL TIME(MIN.) = 2.35 Tc(MIN.) = 11.51 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = INSIDE STREET CROSSFALL (DECIMAL) = 0.020 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 0.30 ц STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.530 1.17 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 2.00 TO NODE 0.23 8.21 AREA AVERAGE FLOW VELOCITY (FEET/SEC.) = SUBAREA LOSS RATE DATA(AMC II): STREET FLOW DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH (FEET) == 164.00 GROUP STREET HALFWIDTH (FEET) = 15.00 Ω FLOW PROCESS FROM NODE STREET LENGTH (FEET) = "8-10 DWELLINGS/ACRE" LAND USE RESIDENTIAL

******************* 10.00 = 356.00 FEET 6.00 IS CODE = 21 DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 8.84
FLOW VELOCITY(FEET/SEC.) = 1.23 DEPTH*VELOCITY(FT*FT/SEC.) =
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 10.00 = 356.00 10.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: 1.04 5.00 TO NODE 10.00 TO NODE 0.47 END OF SUBAREA STREET FLOW HYDRAULICS: RAINFALL INTENSITY (INCH/HR) = 2.53 TIME OF CONCENTRATION (MIN.) = 11.51 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.47 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 EFFECTIVE STREAM AREA(ACRES) = TOTAL NUMBER OF STREAMS = 2 TOTAL STREAM AREA (ACRES) = AREA-AVERAGED Ap = 0.40 FLOW PROCESS FROM NODE FLOW PROCESS FROM NODE

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************************ ELEVATION DATA: UPSTREAM(FEET) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS SUBAREA LOSS RATE DATA(AMC DEVELOPMENT TYPE/ SCS Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.01s DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = INSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH(FEET) = 112.00 CURB HEIGHT(INCHES) = 4.8 >>>> (STREET TABLE SECTION # 1 USED) <<<<< >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA FLOW PROCESS FROM NODE TOTAL AREA(ACRES) = SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 RESIDENTIAL SUBAREA TC AND LOSS RATE DATA (AMC II): SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = INITIAL SUBAREA FLOW-LENGTH (FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = STREET FLOW TRAVEL TIME (MIN.) = 1.71 STREET PARKWAY CROSSFALL (DECIMAL) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020 UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) = 67.90 "8-10 DWELLINGS/ACRE" TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20DEPTH(FEET) = 0.30EFFECTIVE AREA(ACRES) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 LONGEST FLOWPATH FROM NODE FLOW VELOCITY (FEET/SEC.) = 1.12 DEPTH*VELOCITY (FT*FT/SEC.) = END OF SUBAREA STREET FLOW HYDRAULICS: TOTAL AREA(ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/ PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW DEPTH(FEET) = 0.30 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.891 AVERAGE FLOW VELOCITY (FEET/SEC.) = 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.613 LAND USE LAND USE HALFSTREET FLOOD WIDTH (FEET) = 10.59 0.58 SCS SOIL 0.39 PEAK FLOW RATE (CFS) = SCS SOIL GROUP GROUP 0.58 U U 6.00 TO NODE 0.99 II): 5.00 TO NODE (ACRES) (INCH/HR) AREA FP AP (ACRES) (INCH/HR) (DECIMAL) AREA 10.20 PEAK FLOW RATE (CFS) = AREA-AVERAGED Fm(INCH/HR) = 0.08 0.39 0.19 70.00 DOWNSTREAM(FEET) = 253.00 0.020 1.09 Tc(MIN.) = 10.889.178 0.32 10.00 IS CODE = 62 ΨĐ 0.20 0.20 10.00 = (DECIMAL) 0.40 0.40 Ą 0.99 365.00 FEET 0.43 0.0199 1.32 SCS Q 75 Q 75 0.0150 68.18 (MIN.) Tc 9.18

Date: 06/06/11 ********************** ************************* FLOW PROCESS FROM NODE RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS. EFFECTIVE STREAM AREA(ACRES) = RAINFALL INTENSITY(INCH/HR) = TIME OF CONCENTRATION(MIN.) = 10.88 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: TOTAL NUMBER OF STREAMS = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES < < < < >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<< FLOW PROCESS FROM NODE >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< PIPE-FLOW VELOCITY (FEET/SEC.) = 4.58 DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.0 INCHES >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = PEAK FLOW RATE (CFS) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA (ACRES) = AREA-AVERAGED Ap AREA-AVERAGED Fp(INCH/HR) = 0.20AREA-AVERAGED Fm(INCH/HR) = 0.08 TIME OF CONCENTRATION(MIN.) = 11.00 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fm(INCH/HR) = 0.08 RAINFALL INTENSITY (INCH/HR) = TOTAL NUMBER OF STREAMS = 3 ** PEAK FLOW RATE TABLE ** ** CONFLUENCE DATA ** NUMBER NUMBER STREAM STREAM 2 1 2 1 (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 1.32 10.88 1.04 2.34 10.88 2.613 0.20(0.08) 0.40 1.0 2.32 11.51 2.530 0.20(0.08) 0.40 1.0 Ю Ю 11.51 = 0.40 J.C Tc 2.34 Intensity 32.00 Intensity 2.530 0.20(0.08) 0.40 2.613 0.20(0.08) 0.40 1.05 0.12 10.00 TO NODE 1.02 2.34 10.00 TO NODE 20.00 TO NODE 0.58 File name: PROP-10.RES 5.00 TO NODE 2.61 2.60 MANNING'S N = 0.013 5.00 TO NODE 0.58 AREA-AVERAGED Fm(INCH/HR) = 0.08 Tc(MIN.) = 11.00Tc(MIN.) = Fp (Fm) Fp (Fm) 67.90 DOWNSTREAM (FEET) = 1.32 20.00 IS CODE = 31 10.00 IS CODE = 20.00 IS CODE = 1 Αp Αþ 10.00 = 365.00 FEET 20.00 = (ACRES) 10.88 (ACRES) Āе 0.5 HEADWATER HEADWATER 397.00 FEET NODE NODE 1.00 5.00 1.00 67.60

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2.34 EFFECTIVE STREAM AREA(ACRES) = 1.02 PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.05 AREA-AVERAGED Fp(INCH/HR) = 0.20 TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 21 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< 186.00 INITIAL SUBAREA FLOW-LENGTH(FEET) =

69.30 DOWNSTREAM(FEET) =

ELEVATION DATA: UPSTREAM(FEET) =

8.71 (MIN.) S (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 ър * 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.983 0.22 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = AREA SUBAREA TC AND LOSS RATE DATA(AMC II): SCS SOIL 0.57 GROUP 0.22 Q SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/

******************** 22.00 TO NODE 20.00 IS CODE = 62 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE

67.90 UPSTREAM ELEVATION(FEET) = 68.36 DOWNSTREAM ELEVATION(FEET) = 126.00 CURB HEIGHT(INCHES) = 4.8 >>>> (STREET TABLE SECTION # 1 USED) <<<< STREET LENGTH (FEET) =

5.00 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET HALFWIDTH (FEET) = 15.00

0.0150 0.0199 STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

AREA-AVERAGED Fm(INCH/HR) = 0.08 S 0.44 (ACRES) (INCH/HR) (DECIMAL) 0.40 Tc(MIN.) = 10.53SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.29 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.660 Fр 1.15 0.19 7.93 AREA 1.82 AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET FLOW DEPTH(FEET) = 0.25 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL 0.41 STREET FLOW TRAVEL TIME (MIN.) = HALFSTREET FLOOD WIDTH (FEET) = GROUP Ω EFFECTIVE AREA (ACRES) = "8-10 DWELLINGS/ACRE"

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0.95 0.40 PEAK FLOW RATE(CFS) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap END OF SUBAREA STREET FLOW HYDRAULICS: 0.41 TOTAL AREA (ACRES) =

20.00 = 312.00 FEET. DEPTH*VELOCITY (FT*FT/SEC.) = DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH(FEET) = 8.56 21.00 TO NODE FLOW VELOCITY (FEET/SEC.) = 1.20 LONGEST FLOWPATH FROM NODE ****************************** FLOW PROCESS FROM NODE 20.00 TO NODE 20.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: 0.95 TIME OF CONCENTRATION(MIN.) = 10.53 2.66 PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.41 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 EFFECTIVE STREAM AREA (ACRES) = RAINFALL INTENSITY (INCH/HR) = TOTAL NUMBER OF STREAMS = 3 TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

Tc (MIN.) 68.04 J 26.00 IS CODE = 21 (ACRES) (INCH/HR) (DECIMAL) 69.00 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Αp >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.996 INITIAL SUBAREA FLOW-LENGTH(FEET) = 185.00 25.00 TO NODE SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = SUBAREA TC AND LOSS RATE DATA(AMC II): AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = GROUP FLOW PROCESS FROM NODE DEVELOPMENT TYPE/

0.58 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE (CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.22 0.58 0.22 Д SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) =

************************ 20.00 IS CODE = 62 26.00 TO NODE FLOW PROCESS FROM NODE

67.90 UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = 78.00 CURB HEIGHT (INCHES) = >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< >>>> (STREET TABLE SECTION # 1 USED) <<<< STREET LENGTH (FEET) =

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 OUTSIDE STREET CROSSFALL (DECIMAL)

STREET HALFWIDTH (FEET) = 15.00

STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

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*************************
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           EFFECTIVE AREA(ACRES) = 0.33 AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 0.33 PEAK FLOW RATE(CFS) = 0.78
                                                                                                                                                                                                                   CONFLUENCE FORMULA USED FOR 3 STREAMS.
                                                                                                                                                                                                                                                                                                                                                                                                                                    PEAK FLOW RATE (CFS) AT CONFLUENCE =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          RAINFALL INTENSITY (INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TIME OF CONCENTRATION(MIN.) = 10.17
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <>
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       FLOW PROCESS FROM NODE 20.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FLOW VELOCITY (FEET/SEC.) = 0.87
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DEPTH(FEET) = 0.27
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SUBAREA AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA LOSS RATE DATA (AMC II) :
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STREET FLOW TRAVEL TIME (MIN.) =
                   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
                                                                                                                                                                                                                                      RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
                                                                                                                                                                                                                                                                                                                                                                                                                                                           TOTAL STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               EFFECTIVE STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        TOTAL NUMBER OF STREAMS = 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                 ** CONFLUENCE DATA **
PEAK FLOW RATE(CFS) =
                                                                                                                                                                            ** PEAK FLOW RATE TABLE **
                                                                                                                NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR)
1 3.97 10.17 2.708 0.20( 0.0)
                                                                                                                                                                                                                                                                                                                                                          NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                              STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DEVELOPMENT TYPE/
                                                                                                                                                           STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STREET FLOW DEPTH (FEET) = 0.27
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.708
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           LAND USE
                                                                                                                                                                                                                                                                         2.34 11.00
2.32 11.63
0.95 10.53
0.78 10.17
                                                                                              4.01
                                                                                                                                                         Ю
                                                      10.53
11.00
11.63
                                                                                                                                                           Tc
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                         Intensity
                                                                                                                                                                                                                                                                                                                                                                              Intensity
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.11
                                                                                                                                                                                                                                                                           2.598 0.20( 0.08) 0.40
2.515 0.20( 0.08) 0.40
2.660 0.20( 0.08) 0.40
2.708 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           GROUP
                                                        2.598
                                                                                              2.660
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     U
4.01
                                                                                                                                                                                                                                                                                                                                                                                                                                                           0.33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               25.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2.71
                                                    3 0.20( 0.08) 0.40
0 0.20( 0.08) 0.40
3 0.20( 0.08) 0.40
5 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                             0.33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.53
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DEPTH*VELOCITY(FT*FT/SEC.) = 0.24
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 8.77
                                                                                                                                                                                                                                                                                                                                                                            Fp (Fm)
Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SUBAREA RUNOFF(CFS) =
                                                                                                                                                         Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            0.85
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Tc(MIN.) =
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11.00
                                                                                                                                       (ACRES)
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                                                          1.7
1.7
1.8
1.8
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1.0
0.4
0.3
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                                                                                                                                                           HEADWATER
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                                                                                                                                         NODE
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25.00
                                                                                              21.00
                                                                                                                  25.00
                                                          5.00
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                                                                                                                                                                                                                                                                                                                                     5.00
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******************* ************************** OUTSIDE STREET CROSSFALL (DECIMAL) DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = INSIDE STREET CROSSFALL(DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<<< FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 62 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA TC AND LOSS RATE DATA (AMC SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = ELEVATION DATA: UPSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< FLOW PROCESS FROM NODE >>>>MAIN~STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<< FLOW PROCESS FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1 PIPE-FLOW VELOCITY (FEET/SEC.) = DEPTH OF FLOW IN 18.0 INCH PIPE IS ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 EFFECTIVE AREA(ACRES) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH (FEET) = UPSTREAM ELEVATION(FEET) = 68.39 DOWNSTREAM ELEVATION(FEET) = >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< TOTAL AREA(ACRES) = SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 "8-10 DWELLINGS/ACRE" TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20INITIAL SUBAREA FLOW-LENGTH (FEET) = DEVELOPMENT TYPE/ 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.972 LAND USE FLOWPATH FROM NODE 4.01 110.00 140.00 SCS SOIL 1.79 0.22 20.00 TO NODE GROUP 0.34 21.00 TO NODE 30.00 TO NODE U 0.57 1.76 PEAK FLOW RATE (CFS) = MANNING'S N = 0.013 5.00 TO NODE 5.00 TO NODE CURB HEIGHT (INCHES) = 4.8 (ACRES) (INCH/HR) 5.45 = 0.020 67.90 DOWNSTREAM(FEET) = AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA II): Tc(MIN.) = 11.340.22 69.30 DOWNSTREAM (FEET) 7.8 INCHES 186.00 30.00 IS CODE = 31 8.765 30.00 IS CODE = 10 0.20 Ğ 31.00 IS CODE = 20.00 = 397.00 FEET 30.00 = (DECIMAL) 0.40 Αp 507.00 FEET. 0.57 21 CN SCS 75 66.80 67.80 68.39 (MIN.) Tc 8.77

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****************** (ACRES) (INCH/HR) (DECIMAL) CN (MIN.) 8.62 0.0150 68.04 32.00 = 326.00 FEET. SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40

SUBAREA AREA (ACRES) = 0.21

SUBAREA RUNOFF (CFS) = 0.48

EFFECTIVE AREA (ACRES) = 0.43

AREA-AVERAGED FM (INCH/HR) = 0.00

AREA-AVERAGED Ap = 0.40 0.99 Z 0.0199 32.00 IS CODE = 1 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.019 HALFSTREET FLOOD WIDTH(FEET) = 8.42 EC.) = 1.29 DEPTH*VELOCITY(FT*FT/SEC.) = 36.00 IS CODE = 21 (ACRES) (INCH/HR) (DECIMAL) 69.00 DOWNSTREAM (FEET) = 0.40 0.40 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS</</>
>>VSE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA< Αp Αp 1.91 TC(MIN.) = 10.68 PEAK FLOW RATE(CFS) = "8-10 DWELLINGS/ACRE" D 0.22 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.22
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.30 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 8.616 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 8.61
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.001 Ρ̈́D * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.641 0.99 21.00 TO NODE INITIAL SUBAREA FLOW-LENGTH(FEET) = 184.00 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 FLOW PROCESS FROM NODE 32.00 TO NODE 25.00 TO NODE 0.21 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA SUBAREA TC AND LOSS RATE DATA(AMC II): AREA 0.43 END OF SUBAREA STREET FLOW HYDRAULICS: TIME OF CONCENTRATION (MIN.) = 10.68 TOTAL STREAM AREA(ACRES) = 0.43 PEAK FLOW RATE(CFS) AT CONFLUENCE = DEPTH(FEET) = 0.26 HALFSTREET FL FLOW VELOCITY(FEET/SEC.) = 1.29 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 STREET FLOW DEPTH(FEET) = 0.25 EFFECTIVE STREAM AREA(ACRES) = SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW TRAVEL TIME (MIN.) = ELEVATION DATA: UPSTREAM(FEET) = GROUP GROUP RAINFALL INTENSITY (INCH/HR) = Д TOTAL NUMBER OF STREAMS = 2 0.43 LONGEST FLOWPATH FROM NODE AREA-AVERAGED Ap = 0.40 FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ RESIDENTIAL

****************** 32.00 = 248.00 FEET. AREA-AVERAGED Fm(INCH/HR) = 0.08 0.79 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 CS UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = 7.86
FLOW VELOCITY(FRET/SEC.) = 1.16 DEPTH*VELOCITY(FT*FT/SEC.) =
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 32.00 = 248.00 32.00 IS CODE = 1 32.00 IS CODE = 62 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 0.40
 EFFECTIVE AREA (ACRES)
 0.32
 AREA-AVERAGED FM (INCH/HR)

 AREA-AVERAGED Fp (INCH/HR)
 0.20
 AREA-AVERAGED Ap = 0.40

 TOTAL AREA (ACRES)
 0.32
 PEAK FLOW RATE (CFS) =
 64.00 CURB HEIGHT (INCHES) = 4.8 9.57 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = Tc(MIN.) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 PEAK FLOW RATE(CFS) 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.815 1.12 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 36.00 TO NODE >>>> (STREET TABLE SECTION # 1 USED) <<<< PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 32.00 TO NODE 0.10 AREA STREET FLOW TRAVEL TIME (MIN.) = 0.95 END OF SUBAREA STREET FLOW HYDRAULICS: AVERAGE FLOW VELOCITY (FEET/SEC.) = TIME OF CONCENTRATION(MIN.) = 9.57 PEAK FLOW RATE(CFS) AT CONFLUENCE = SUBAREA LOSS RATE DATA(AMC II): OUTSIDE STREET CROSSFALL (DECIMAL) AREA-AVERAGED Fp(INCH/HR) = 0.20 STREET FLOW DEPTH(FEET) = 0.24 AREA-AVERAGED Fm(INCH/HR) = 0.08 HALFSTREET FLOOD WIDTH (FEET) = GROUP EFFECTIVE STREAM AREA(ACRES) = STREET HALFWIDTH (FEET) = 15.00 0.10 RAINFALL INTENSITY (INCH/HR) = Д TOTAL NUMBER OF STREAMS = 2 TOTAL STREAM AREA (ACRES) = AREA-AVERAGED Ap = 0.40 FLOW PROCESS FROM NODE FLOW PROCESS FROM NODE SUBAREA AREA (ACRES) = STREET LENGIH (FEET) = "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = RESIDENTIAL

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PEAK FLOW RATE (CFS) = 1.74 Tc (MIN.) = 9.57

EFFECTIVE AREA (ACRES) = 0.71 AREA-AVERAGED FM (INCH/HR) = 0.08

AREA-AVERAGED FP (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.40 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS. PIPE-FLOW(CFS) = 1.7 PIPE TRAVEL TIME(MIN.) = DEPTH OF FLOW IN 18.0 INCH PIPE IS 2.8 INCHES LONGEST FLOWPATH FROM NODE ** MEMORY BANK # 1 CONFLUENCE DATA ** LONGEST FLOWPATH FROM NODE ** MAIN STREAM CONFLUENCE DATA ** >>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY << < < FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1 PIPE-FLOW VELOCITY (FEET/SEC.) = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE 32.00 TO NODE LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: ** PEAK FLOW RATE TABLE ** ** CONFLUENCE DATA ** ** PEAK FLOW RATE TABLE ** STREAM NUMBER NUMBER STREAM NUMBER STREAM NUMBER STREAM STREAM NUMBER 4 3 2 1 N (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) 1.74 9.57 2.815 0.20(0.08) 0.40 0.7 1.73 10.68 2.641 0.20(0.08) 0.40 0.8 (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 4.01 4.01 3.94 Q Tc Intensity Fp(Fm) (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 3.97
 1.74
 9.58
 2.812
 0.20(0.08) 0.40
 0.7

 1.73
 10.69
 2.638
 0.20(0.08) 0.40
 0.8
 0.79 9.57 0.99 10.68 Ø 5.57 9.58 2.812 0.20(0.08) 0.40 2.2 10.51 10.87 11.34 11.97 Tc Ťc Tc Intensity 1.74 Intensity Intensity 10.00 Intensity 2.641 0.20(0.08) 0.40 2.815 0.20(0.08) 0.40 2.663 0.20(0.08) 0.40 2.616 0.20(0.08) 0.40 2.553 0.20(0.08) 0.40 2.470 0.20(0.08) 0.40 0.75 0.02 Tc(MIN.) = 30.00 TO NODE 21.00 TO NODE MANNING'S N = 0.013 21.00 TO NODE 21.00 TO NODE 5.00 TO NODE 9.74 Fp (Fm) Fp (Fm) Fp (Fm) Fp (Fm) 67.80 DOWNSTREAM(FEET) = 30.00 IS CODE = 11 30.00 IS CODE = 31 Ą Α̈́ρ Αp Αp Αp 9.58 32.00 = 326.00 FEET 30.00 = 336.00 FEET. (ACRES) (ACRES) 30.00 = (ACRES) 30.00 = (ACRES) Аe Аe Аe Ae Аe 0.4 1.7 1.7 1.8 1.8 HEADWATER HEADWATER HEADWATER HEADWATER HEADWATER 336.00 FEET 507.00 FEET NODE NODE NODE NODE NODE 25.00 1.00 25.00 21.00 25.00 21.00 25.00 21.00 25.00 66.80

	TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.237 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.879 SUBAREA TC AND LOSS RATE DATA(AMC II):
	>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA< <pre>====================================</pre>

	AMS = 3 ED FOR INDEPENDENT STREAM 1 ARE: N(MIN.) = 10.96 NCH(H)R) = 2.60 H(HR) = 0.08 H(HR) = 0.20 0.40 0.40 0.40 0.40 0.40 0.40 0.40 0.47 AT CONFLUENCE = 5.72
	>>>>DESIGNATE INDEPENDENT STREAM FOR CONFILIENCE <<<<

	ANNING'S N = 0.013 IS 10.9 INCHES 5.10 18.00 NUMBER OF PIPES = 1 TC (MIN.) = 10.96 5.00 TO NODE 40.00 = 537.00 FEE
	>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA-<<< >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<< ================================
	>>>>CLEAR MEMORY BANK # 1 <<<<<

	COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE (CFS) = 5.72 TC (MIN.) = 10.866 EFFECTIVE AREA(ACRES) = 2.47 AREA-AVERAGED Fm (INCH/HR) = 0.08 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 TOTAL AREA(ACRES) = 2.54 LONGEST FLOWPATH FROM NODE 5.00 TO NODE 30.00 = 507.00 FEET.
	5.55 11.97 2.470 0.20(0.08) 0.40 2.5 AL AREA(ACRES) = 2.54
	5.72 10.87 2.538 0.20(0.08) 0.40 2.5 5.72 10.87 2.616 0.20(0.08) 0.40 2.5 5.68 11.34 2.553 0.20(0.08) 0.40 2.5
	2.663 0.20(0.08) 0.40 2.
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(MIN.) 9.24 (ACRES) (INCH/HR) (DECIMAL) CN 0.58 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.23 AREA 0.58 0.23 Д SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ LAND USE

FLOW PROCESS FROM NODE 41.00 TO NODE 42.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<

UPSTREAM ELEVATION(FEET) = 68.53 DOWNSTREAM ELEVATION(FEET) = >>>> (STREET TABLE SECTION # 1 USED) <<<<

68.00 115.00 CURB HEIGHT(INCHES) = 4.8 STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH (FEET) =

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 INSIDE STREET CROSSFALL(DECIMAL) = 0.020 = 0.020OUTSIDE STREET CROSSFALL (DECIMAL)

0.0150 0.0199 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.019 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

S AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp Tc(MIN.) = 10.76 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.20 AVERAGE FLOW VELOCITY(FRET/SEC.) = 1.26
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.30 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.629 0.19 SUBAREA LOSS RATE DATA(AMC II); DEVELOPMENT TYPE/ SCS SOIL AREA 1.53 STREET FLOW DEPTH(FEET) = 0.24 HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW TRAVEL TIME (MIN.) = GROUP Д "8-10 DWELLINGS/ACRE" RESIDENTIAL

DEPTH (FEET) = 0.26 HALFSTREET FLOOD WIDTH (FEET) = 8.21
PLOW VELOCITY (FEET/SEC.) = 1.31 DEPTH*VELOCITY (FT*FT/SEC.) = 0.33 42.00 = 307.00 FEET. 1.00 TO NODE END OF SUBAREA STREET FLOW HYDRAULICS: LONGEST FLOWPATH FROM NODE

AREA-AVERAGED Fm(INCH/HR) = 0.08

EFFECTIVE AREA (ACRES) = 0.42 AREA-AVERAGED FM (INCH/HR)
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA (ACRES) = 0.42 PEAK FLOW RATE (CFS) =

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20

0.44

96.0

FLOW PROCESS FROM NODE 42.00 TO NODE 42.00 IS CODE = 81 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<

SCS CN 75 Ap (DECIMAL) 0.20 AREA FP (ACRES) (INCH/HR) 0.20 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.629 0.07 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL GROUP MAINLINE TC(MIN) = 10.76 LAND USE APARTMENTS

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 SUBAREA AVERAGE PERVIOUS
 AREA FRACTION, Ap = 0.20

 CORTARRA PERACHACRES) = 0.00
 0.07
 SUBAREA RUNDFF(CES) = 0.16

 SEPECTIVE AREA (ACKES) = 0.49
 0.49
 AREA-AVERAGED FM(INCH/HR) = 0.07

 AREA-AVERAGED FP (INCH/HR) = 0.20
 AREA-AVERAGED PP = 0.37
 PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 0.49 TOTAL AREA (ACRES) = 40.00 IS CODE = 31 FLOW PROCESS FROM NODE 42.00 TO NODE

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) < >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<

68.00 DOWNSTREAM(FEET) = ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = FLOW LENGTH (FEET) = 65.00 MANNING'S N = 0.013 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.3 INCHES PIPE-FLOW VELOCITY (FEET/SEC.) = 5.00 ELEVATION DATA: UPSTREAM(FEET) =

40.00 = 372.00 FEET. Tc(MIN.) = 10.98 1.00 TO NODE 0.22 LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME(MIN.) =

1.13

PIPE-FLOW(CFS) =

******************************** 40.00 IS CODE = 1 40.00 TO NODE FLOW PROCESS FROM NODE

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: EFFECTIVE STREAM AREA (ACRES) = 0.49 TIME OF CONCENTRATION(MIN.) = 10.98 AREA-AVERAGED Fm(INCH/HR) = 0.07 AREA-AVERAGED Fp(INCH/HR) = 0.20 RAINFALL INTENSITY(INCH/HR) = TOTAL NUMBER OF STREAMS = 3 0.37 AREA-AVERAGED Ap =

5.00 TO NODE 45.00 IS CODE = 21 FLOW PROCESS FROM NODE

1.13

0.49

PEAK FLOW RATE(CFS) AT CONFLUENCE =

TOTAL STREAM AREA(ACRES) =

INITIAL SUBAREA FLOW-LENGTH (FEET) = 253.00
ELEVATION DATA: UPSTREAM (FEET) = 70.00 DOWNSTREAM (FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<

68.18

(MIN.) (ACRES) (INCH/HR) (DECIMAL) CN SUBAREA ANALYSIS USED MINIMUM TC (MIN.) = 9.178

* 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.891
SUBAREA TC AND LOSS RATE DATA(AMC II): Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 Fр AREA SCS SOIL GROUP DEVELOPMENT TYPE/

1.01 0.40 "8-10 DWELLINGS/ACRE" D 0.40 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 PEAK FLOW RATE(CFS) = 1.01 0.40 SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) =

************************* 45.00 TO NODE

46.00 IS CODE = 62 FLOW PROCESS FROM NODE

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```
SUBAREA LOSS RATE DATA (AMC DEVELOPMENT TYPE/ SCS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 STREET HALFWIDTH (FEET) = 15.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA
                                                                                                                                                                                                                SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.20
SUBAREA AREA(ACRES) = 0.07
SUBAREA RUNOFF(CFS) =
EFFECTIVE AREA(ACRES) = 0.57
AREA-AVERAGED Fm(INCH/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                DEPTH(FEET) = 0.24 HALFSTREET FLOOD WIDTH(FEET) = 7.43
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             TOTAL AREA(ACRES) = 0.50
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        EFFECTIVE AREA(ACRES) = 0.50 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA AVERAGE PERVIOUS LOSS RATE, FD(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STREET PARKWAY CROSSFALL (DECIMAL) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) = 67.50
                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA LOSS RATE DATA (AMC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                MAINLINE TC (MIN) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        FLOW VELOCITY (FEET/SEC.) = 1.99 DEPTH*VELOCITY (FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              RESIDENTIAL
                                                                                FLOW PROCESS FROM NODE
                                                                                                                                                                TOTAL AREA(ACRES) =
                                                                                                                                                                                        AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.38
                                                                                                                                                                                                                                                                                                                                APARTMENTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                "8-10 DWELLINGS/ACRE"
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
                          >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                  DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           STREET FLOW DEPTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                           10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.797
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.797
                                                                                                                                                                                                                                                                                                                                                          LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              57.00 CURB HEIGHT (INCHES) = 4.8
                                                                                                                                                                0.57
                                                                                                                                                                                                                                                                                                                                                                                     SCS SOIL
                                                                                                                                                                                                                                                                                                                                                          GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           GROUP
                                                                                46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ט
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                                                                                                                                                                                                                                                                                                                                                                                                                II):
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                          (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.48
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              7.15
                                                                                                                                                             PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                     AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                  AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.10
                                                                                                                                                                                                                                                                                                                                0.07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        1.98
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Tc(MIN.) = 9.66
                                                                                40.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             46.00 IS CODE = 81
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.46
                                                                                                                                                                                                                                                                                                                                                                                  Fρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Ε̈́ρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.20
                                                                                                                                                                                                                                                                                                                             0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             46.00 = 310.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              5.00
                                                                                                                                                                                                                                                                                                                             0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.40
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.24
                                                                                                                                                                                                                                                0.17
                                                                                                                                                                1.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   1.22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           Q
                                                                                                                                                                                                                                                                                                                                  75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   75
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PIPE-FLOW VELOCITY (FEET/SEC.) = 5.41 ESTIMATED PIPE DIAMETER (INCH) = 18.00 ** PEAK FLOW RATE TABLE ** CONFLUENCE FORMULA USED FOR PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA(ACRES) = EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Ap AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Fm(INCH/HR) = 0.08 TIME OF CONCENTRATION(MIN.) = 9.78
RAINFALL INTENSITY(INCH/HR) = 2.77 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE: TOTAL NUMBER OF STREAMS = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES < < < < >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE < < < < FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1 LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.7 INCHES ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO ** CONFLUENCE DATA ** NUMBER STREAM (CFS) (MIN.) (INCH/HR) 5.55 5.68 5.72 5.72 5.70 5.57 10.61 11.44 12.07 10.98 10.96 9.78 9.68 1.40 40.00 Intensity 2.792 2.650 2.625 2.603 2.540 2.457 2.601 0.12 Tc(MIN.) = 9.782.773 3 STREAMS 0.57 MANNING'S N = 0.0135.00 TO NODE 0.20(0.08) 0.20(0.08) 0.20(0.08) 0.20(0.08) 0.40 0.20(0.08) 0.40 0.20(0.07) 0.20(0.08) 0.20(0.08) 0.40 (INCH/HR) 67.50 DOWNSTREAM(FEET) = Fp (Fm) 1.40 NUMBER OF PIPES = 0.40 0.37 0.38 Αþ 40.00 = 350.00 FEET. (ACRES) Аe 0.55544 HEADWATER NODE 25.00 21.00 21.00 5.00 1.00 1.00 25.00 66.60

LONGEST FLOWPATH FROM NODE	TOTAL AREA(ACRES) =	AREA-AVER	EFFECTIVE AREA(ACRES)	PEAK FLOW RATE(CFS) =	COMPUTED	œ	7	σ	ப	4	ω	2	1	NUMBER	STREAM	
TOWDATI	A (ACRE	AGED F	AREA(i	RATE (CONFLU	7.85	8.06	8.15	8.16	8.16	8.14	8.05	8.03	(CFS)	Ø	
	11)(INCH/	ACRES) =	CFS) =	ENCE ES	12.07	11.44	10.98	10.96	10.79	10.61	9.78	9.68	(MIN.)	Tc	
	3.60	AREA-AVERAGED Fp(INCH/HR) = 0.20	= 3.50	8.16	COMPUTED CONFLUENCE ESTIMATES ARE	2.457	2.540	2.601	2.603	2.625	2.650	2.773	2.792	(INCH/HR)	Intensity	
				Tc(MIN.) =	E AS FOLLOWS:	0.20(0.08) 0.39	0.20(0.08) 0.39	0.20(0.08) 0.39	0.20(0.08) 0.39	0.20(0.08) 0.39	0.20(0.08)	0.20(0.08)	0.20(0.08)	(INCH/HR)	Fp (Fm)	
SKAGED	KAGED	1	RAGED	н	S	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39		Αp	
		AREA-AVERAGED Ap = 0.39	AREA-AVERAGED Fm(INCH/HR)	10.79		3.6	3.6	3.5	3.5	3.5	3.5	3.3	3.2	(ACRES)	Ae	
		39	Н						N)	N	N		N	NODE	HEADWATER	
537 OO FEET			0.08			1.00	5.00	1.00	21.00	21.00	25.00	5.00	25.00	[-]	TER	

40.00 TO NODE

50.00 IS CODE = 31

FLOW PROCESS FROM NODE

Date: 06/06/11 File name: PROP-10.RES

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<-<->
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<-<->
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<-<->
>>>>COMPUTE COMPUTER-ESTIMATED PIPESIZE (NOW-PRESSURE FLOW) <-<->
ELEVATION DATA: UPSTREAM (FRET) = 66.00 DOWNSTREAM (FRET) = 65.30

PLOW LENGTH (FRET) = 330.00 MANNING'S N = 0.013

DEPTH OF PLOW IN 2.10 INCH PIPE IS 14.8 INCHES

PIPE-TOW VELOCITY (FRET) / 25.00

PIPE-FLOW (CES) = 8.16

PIPE TRAVEL TIME (MIN.) = 12.01

LONGEST FLOWPATH FROM NODE 5.00 TO NODE 50.00 = 867.00 FRET.

END OF STUDY SUMMARY:

12.01
EFFECTIVE AREA (ACRES) = 3.60 TC(MIN.) = 12.01
EFFECTIVE AREA (ACRES) = 3.50 AREA-AVERAGED FM(INCH/HR) = 0.08
PREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39
PEAK FLOW RATE (CFS) = 8.16

** PEAK FLOW RATE TABLE **

STREAM
Q TC Intensity Fp(Fm) Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (NOH) 0.39
1 8.03 10.90 2.598 0.20(0.08) 0.39 3.3 5.00
3 8.14 11.82 2.489 0.20(0.08) 0.39 3.5 25.00
4 8.16 12.01 2.465 0.20(0.08) 0.39 3.5 25.00
5 8.15 12.20 2.440 0.20(0.08) 0.39 3.5 10.00
6 8.15 12.20 2.440 0.20(0.08) 0.39 3.5 10.00
7 8.06 12.66 2.385 0.20(0.08) 0.39 3.6 5.00

END OF RATIONAL METHOD ANALYSIS

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Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\PROP-25.DAT TIME/DATE OF STUDY: 09:19 06/06/2011

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD* USER SPECIFIED STORM EVENT(YEAR) = 25.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 *DATA BANK RAINFALL USED*

MANNING HERRORE HERRORE HERRORE 1.00 0.0312 0.080 0.0150 (H *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* CURB GUTTER-GEOMETRIES: HEIGHT WIDTH LIP HIKE (FT) (FI) (FT) 0.40 (FI) 0.020/0.020/0.020 STREET-CROSSFALL: IN- / OUT-/PARK-SIDE / SIDE/ WAY CROSSFALL HALF- CROWN TO 5.0 (FT) 1 15.0 NO. (FT)

1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

AREA-AVERAGED Fm(INCH/HR) = 0.08

AREA-AVERAGED FP (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.47

TOTAL AREA (ACRES) = 0.47

PEAK FILM DATE (ACRES) = 0.47

PEAK FILM DATE (ACRES) = 0.47

1.25

2. (Depth) * (Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

(MIN.) 9.17 S 2.00 IS CODE = 21 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 69.30 DOWNSTREAM(FEET) = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< 0.20 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.423 INITIAL SUBAREA FLOW-LENGTH(FEET) = 192.00 FLOW PROCESS FROM NODE 1.00 TO NODE 0.24 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = SUBAREA TC AND LOSS RATE DATA(AMC II): SCS SOIL GROUP Д "8-10 DWELLINGS/ACRE" RESIDENTIAL

0.0150 UPSTREAM ELEVATION(FEET) = 68.50 DOWNSTREAM ELEVATION(FEET) = 67.90 S 75 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = 0.40
SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = 0.61 1.03 (ACRES) (INCH/HR) (DECIMAL) 10.00 IS CODE = 0.40 CURB HEIGHT (INCHES) = 4.8 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = Ap DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 Tc(MIN.) = 11.41>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 0.33 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: STREET FLOW TRAVEL TIME(MIN.) = 2.24 TC(MIN. * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.041 ď, AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.22 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.020 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< INSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.23 2.00 TO NODE 8.84 AREA STREET PARKWAY CROSSFALL (DECIMAL) = STREET FLOW DEPTH(FEET) = 0.27 SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL 164.00 GROUP STREET HALFWIDTH (FEET) = 15.00 О FLOW PROCESS FROM NODE STREET LENGTH (FEET) = "8-10 DWELLINGS/ACRE"

************************* 10.00 = 356.00 FEET. DEPTH*VELOCITY(FT*FT/SEC.) = 0.36 FLOW PROCESS FROM NODE 10.00 TO NODE 10.00 IS CODE = 1 DEPTH(FEET) = 0.28 HALFSTREET FLOOD WIDTH(FEET) = 9.54 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: 1.25 1.00 TO NODE 0.47 END OF SUBAREA STREET FLOW HYDRAULICS: TIME OF CONCENTRATION (MIN.) = 11.41 RAINFALL INTENSITY (INCH/HR) = 3.04 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.47 FLOW VELOCITY (FEET/SEC.) = 1.29 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 EFFECTIVE STREAM AREA(ACRES) = TOTAL NUMBER OF STREAMS = 2 LONGEST FLOWPATH FROM NODE TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

6.00 IS CODE = 21 5.00 TO NODE FLOW PROCESS FROM NODE

0.72

PEAK FLOW RATE(CFS)

SUBAREA AVERAGE PERVIOUS LOSS RATE, Pp(INCH/HR) = 0.20

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40

0.72

SUBAREA RUNOFF (CFS) =

TOTAL AREA (ACRES) =

0.24

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******************************
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         >>>> (STREET TABLE SECTION # 1 USED) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA TC AND LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS
                                                                                                                                                                                                                                                                                              AREA-AVERAGED FM (INCH/HR) = 0.58

AREA-AVERAGED FM (INCH/HR) = 0.20

TOTAL AREA (ACRES) = 0.58

PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PEAK FT (APPROXIMENTATION OF THE PE
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 STREET LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     INITIAL SUBAREA FLOW-LENGTH (FEET) =
                                                                                         LONGEST FLOWPATH FROM NODE
                                                                                                                                            FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           Manning's FRICTION FACTOR for Back-of-Walk Flow Section =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                  DEPTH(FEET) = 0.32
                                                                                                                                                                                                                                      END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RESIDENTIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STREET FLOW DEPTH(FEET) = 0.31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.448
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.133
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LAND USE
                                                                                                                                                                                       HALFSTREET FLOOD WIDTH (FEET) = 11.37
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 112.00 CURB HEIGHT (INCHES) = 4.8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.39 PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SCS SOIL
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.18
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                                                                                             5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.64
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                                                                                                                                            DEPTH*VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     10.98
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA RUNOFF (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.19
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          253.00
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                                                                                             10.00 = 365.00 FEET
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Date: 06/06/11 **************************** >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES << < < TIME OF CONCENTRATION(MIN.) = 10.82
RAINFALL INTENSITY(INCH/HR) = 3.13 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< FLOW PROCESS FROM NODE >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE CONFLUENCE FORMULA USED FOR 2 STREAMS. PEAK FLOW RATE (CFS) AT CONFLUENCE = EFFECTIVE STREAM AREA (ACRES) = 0.58 AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Fm(INCH/HR) = 0.08 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: TOTAL NUMBER OF STREAMS = CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< LONGEST FLOWPATH FROM NODE EFFECTIVE AREA(ACRES) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO ** CONFLUENCE DATA ** AREA-AVERAGED Fm(INCH/HR) = 0.08 RAINFALL INTENSITY (INCH/HR) = TIME OF CONCENTRATION(MIN.) = 10.93 TOTAL NUMBER OF STREAMS = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE < < < < PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1 PIPE-FLOW VELOCITY (FEET/SEC.) = DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.6 INCHES ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = TOTAL AREA(ACRES) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 PEAK FLOW RATE (CFS) = ** PEAK FLOW RATE TABLE ** NUMBER STREAM NUMBER STREAM (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 2.82 10.82 3.133 0.20(0.08) 0.40 1.0 2.80 11.41 3.041 0.20(0.08) 0.40 1.0
 1.25
 11.41
 3.041
 0.20(0.08)
 0.40
 0.5

 1.59
 10.82
 3.133
 0.20(0.08)
 0.40
 0.6
 Tc Τc 2.82 32.00 Intensity Intensity 3.041 0.11 2.82 10.00 TO NODE 1.03 AREA-AVERAGED Fm(INCH/HR) = 0.08 20.00 TO NODE 10.00 TO NODE MANNING'S N = 0.013 5.00 TO NODE 5.00 TO NODE 4.83 0.58 Fp (Fm) 67.90 DOWNSTREAM(FEET) = Fp (Fm) TC(MIN.) = 10.93Tc(MIN.) = 1.59 10.00 IS CODE = 20.00 IS CODE = 31 20.00 IS CODE = 1 Αp Αp 10.00 = 365.00 FEET 20.00 = 397.00 FEET. (ACRES) (ACRES) Ãе Аe HEADWATER HEADWATER NODE NODE 5.00 5.00 1.00 67.60

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Page 5 (MIN.) ************************* ***************** INITIAL SUBAREA FLOW-LENGTH(FEET) = 186.00 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150 67.90 68.36 AREA-AVERAGED Fm(INCH/HR) = 0.08 (ACRES) (INCH/HR) (DECIMAL) CN SCS S 75 UPSTREAM ELEVATION(FEET) = 68.36 DOWNSTREAM ELEVATION(FEET) = STREET LENGTH(FEET) = 126.00 CURB HEIGHT(INCHES) = 4.8 0.0199 0.53 FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 21 22.00 TO NODE 20.00 IS CODE = 62 0.69 (ACRES) (INCH/HR) (DECIMAL) 69.30 DOWNSTREAM(FEET) = 0.40 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Manning's FRICTION FACTOR for Back-of-Walk Flow Section = Αb DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 Tc(MIN.) = 10.46SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" D 0.19 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Pp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40PEAK FLOW RATE(CFS) = >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.32 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.554 SUBAREA TC AND LOSS RATE DATA(AMC II): G, STREET FLOW TRAVEL TIME(MIN.) = 1.75 TC(MIN. * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.189 ďн 2.82 1.20 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< INSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.22 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.56 AREA AREA EFFECTIVE STREAM AREA (ACRES) = 1.03 AVERAGE FLOW VELOCITY (FEET/SEC.) = PEAK FLOW RATE (CFS) AT CONFLUENCE = 1,05 STREET PARKWAY CROSSFALL (DECIMAL) STREET FLOW DEPTH (FEET) = 0.26 SCS SOIL AREA-AVERAGED Fp(INCH/HR) = 0.20 SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = 0.41 SUBAREA LOSS RATE DATA(AMC II): 0.69 STREET HALFWIDTH (FEET) = 15.00 GROUP GROUP 0.19 0.22 Ω TOTAL STREAM AREA(ACRES) = EFFECTIVE AREA (ACRES) = FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = SUBAREA AREA (ACRES) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ DEVELOPMENT TYPE/ AREA-AVERAGED AP RESIDENTIAL RESIDENTIAL

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1.15 0.40 PEAK FLOW RATE(CFS) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = TOTAL AREA (ACRES) = 0.41 PEAK FLOW RATE(CFS) TOTAL AREA (ACRES) =

20.00 = 312.00 FEET. FLOW VELOCITY(FEET/SEC.) = 1.25 DEPTH*VELOCITY(FT*FT/SEC.) = DEPTH(FEET) = 0.28 HALFSTREET FLOOD WIDTH(FEET) = 9.26 21.00 TO NODE END OF SUBAREA STREET FLOW HYDRAULICS: LONGEST FLOWPATH FROM NODE ****************** FLOW PROCESS FROM NODE 20.00 TO NODE 20.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: TIME OF CONCENTRATION(MIN.) = 10.46 RAINFALL INTENSITY (INCH/HR) = 3.19 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 TOTAL NUMBER OF STREAMS = 3

26.00 IS CODE = 21 25.00 TO NODE FLOW PROCESS FROM NODE

1.15

0.41

PEAK FLOW RATE(CFS) AT CONFLUENCE =

EFFECTIVE STREAM AREA(ACRES) =

TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

68.04 69.00 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< INITIAL SUBAREA FLOW-LENGTH(FEET) = 185.00 ELEVATION DATA: UPSTREAM(FEET) =

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20

SUBAREA ANALYSIS USED MINIMUM TC(MIN.) =

* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.569

8.644

(MIN.) Z 0.69 (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 ър 0.22 AREA SUBAREA TC AND LOSS RATE DATA(AMC II): SCS SOIL 0.69 GROUP 0.22 Ω "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ RESIDENTIAL

******************* 20.00 IS CODE = 62 26.00 TO NODE FLOW PROCESS FROM NODE

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<

>>>> (STREET TABLE SECTION # 1 USED) <<<<

67.90 UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = 78.00 CURB HEIGHT (INCHES) = 4.8 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH (FEET) =

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

= 0.020

OUTSIDE STREET CROSSFALL (DECIMAL)

0.0150 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  EFFECTIVE AREA(ACRES) = 0.33 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.40 TOTAL AREA(ACRES) = 0.33 PEAK FLOW RATE(CFS) = 0.94
PEAK FLOW RATE (CFS) =
                   COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
                                                                                                                                                                             ** PEAK FLOW RATE TABLE **
                                                                                                                                                                                                                    CONFLUENCE FORMULA USED FOR 3 STREAMS
                                                                                                                                                                                                                                        RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIC
                                                                                                                                                                                                                                                                                                                                                                                                    ** CONFLUENCE DATA **
                                                                                                                                                                                                                                                                                                                                                                                                                                         PEAK FLOW RATE (CFS) AT CONFLUENCE =
                                                                                                                                                                                                                                                                                                                                                                                                                                                              TOTAL STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  EFFECTIVE STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              RAINFALL INTENSITY (INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 TIME OF CONCENTRATION (MIN.) = 10.11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          TOTAL NUMBER OF STREAMS = 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE < < < <
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FLOW VELOCITY(FEET/SEC.) = 0.91
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DEPTH(FEET) = 0.29 HALFSTREET FLOOD WIDTH(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA AREA (ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SUBAREA LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                        NUMBER
                                                                                                                                                                                                                                                                                                                                                             NUMBER
                                                                                                                                                          STREAM
                                                                                                                                                                                                                                                                                                                                                                                STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            STREET FLOW DEPTH (FEET) = 0.28
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.242
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LAND USE
                                                                                                                                    (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                           (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                             2.80
1.15
0.94
                                                                                             4.83
                                                                                                                                                                                                                                                                                                                                       2.82
                                                                                                                   4.79 10.11
                                                                                                                                                          Ю
                                                                                                                                                                                                                                                                             10.93
11.52
10.46
10.11
                                                      10.46
10.93
11.52
                                                                                                                                                                                                                                                                                                                                                                                Tc
                                                                                                                                                            'n
                                                                                                                                                          Intensity
                                                                                                                                                                                                                                                                                                                                                                            Intensity
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.11
                                                      3.242 0.20( 0.08) 0.40
3.189 0.20( 0.08) 0.40
3.116 0.20( 0.08) 0.40
3.023 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       0.33
                                                                                                                                                                                                                                                                             3.116 0.20( 0.08) 0.40
3.023 0.20( 0.08) 0.40
3.189 0.20( 0.08) 0.40
3.242 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          20.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         U
4.84
                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  25.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              3.24
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                (ACRES) (INCH/HR) (DECIMAL) CN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DEPTH*VELOCITY(FT*FT/SEC.) = 0.26
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              1.47
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    AREA
Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         9.47
                                                                                                                                                          Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.88
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          Tc(MIN.) = 10.11
                                                                                                                                                                                                                                                                                                                                                                                                                                           0.94
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          20.00 IS CODE = 1
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.25
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                                                                                                                                                          Αp
                                                                                                                                                                                                                                                                                                                                                                            Āρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  20.00 = 263.00 FEET
10.93
                                                                                                                                      (ACRES)
                                                                                                                                                                                                                                                                                                                                                             (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.20
                                                                                                                                                                                                                                                                                                                                                                                Аe
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           9.82
                                                                                                                                                                                                                                                                               1.0
1.0
0.4
                                                                        1.7
1.7
1.8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    φĄ
                                                                                                                                                          HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.85
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.31
                                                                                                                                        NODE
                                                                                                                                                                                                                                                                                                                                                               NODE
                                                                                               21.00
                                                                                                                                                                                                                                                                                                                  1.00
                                                                                                                   25.00
                                                          5.00
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                                                                                                                                                                                                                                           >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DEPTH OF FLOW IN 18.0 INCH PIPE IS
PIPE-FLOW VELOCITY (FEET/SEC.) = 5.71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                      >>>> (STREET TABLE SECTION # 1 USED) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           FLOW LENGTH(FEET) = 110.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             EFFECTIVE AREA(ACRES) =
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =
                                                  OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                        DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                              STREET HALFWIDTH (FEET) = 15.00
                                                                                                                                                                                        STREET LENGTH (FEET) =
                                                                                                                                                                                                                   UPSTREAM ELEVATION(FEET) = 68.39 DOWNSTREAM ELEVATION(FEET) =
                                                                                                                                                                                                                                                                                                 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                      FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 62
                                                                                                                                                                                                                                                                                                                                                                                                                                       TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                RESIDENTIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA TC AND LOSS RATE DATA(AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           INITIAL SUBAREA FLOW-LENGTH (FEET) = 186.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           PIPE TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PIPE-FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.541
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        4.84
                                                                                                                                                                                      140.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                       0.22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.79
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           0.32
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  30.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         20.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    21.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.69
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          1.77
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         MANNING'S N = 0.013
                                                                                                                                                                                                                                                                                                                                                                                                                                       PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  5.00 TO NODE
                                                                                                                                                                                        CURB HEIGHT (INCHES) = 4.8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           Tc(MIN.) = 11.25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      67.90 DOWNSTREAM (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0:22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      69.30 DOWNSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        8.7 INCHES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         30.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    31.00 IS CODE = 21
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  30.00 IS CODE = 10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Ę
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          20.00 = 397.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                30.00 =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        (DECIMAL) CN (MIN.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Αp
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  507.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                       0.69
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SCS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      66.80
                                                                                                                                                                                                                   67.80
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      68.39
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     8.77
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Date: 06/06/11 File name: PROP-25.RES

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(ACRES) (INCH/HR) (DECIMAL) CN (MIN.) 8.62 ************************ 0.0150 68.04 EFFECTIVE AREA (ACRES) = 0.43 AREA-AVERAGED FMILNCH/HR) = 0.08 AREA-AVERAGED FP (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.40 0.0199 S DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 9.12 FLOW VELOCITY(FEET/SEC.) = 1.34 DEPTH*VELOCITY(FT*FT/SEC.) = 32.00 IS CODE = 1 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.019 36.00 IS CODE = 21 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 69.00 DOWNSTREAM(FEET) = 0.40 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Ap Tc(MIN.) = 10.60 32.00 = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.21 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = "8-10 DWELLINGS/ACRE" D 0.22 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, $P_{\rm D}({\rm INCH/HR}) = 0.20$ SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE << < < CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.27
PRODUCT OF DEPTH&VELOCITY(FT**FT/SEC.) = 0.33 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 8.616 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 8.61 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.576 д * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.166 1.19 INITIAL SUBAREA FLOW-LENGTH (FEET) = 184.00 21.00 TO NODE STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 FLOW PROCESS FROM NODE 32.00 TO NODE 25.00 TO NODE 0.21 1.84 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA : (II AREA 0.43 END OF SUBAREA STREET FLOW HYDRAULICS: TIME OF CONCENTRATION(MIN.) = 10.60
RAINFALL INTENSITY(INCH/HR) = 3.17 TOTAL STREAM AREA(ACRES) = 0.43 PEAK FLOW RATE(CFS) AT CONFLUENCE = SUBAREA TC AND LOSS RATE DATA (AMC STREET FLOW DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH(FEET) = AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 SCS SOIL EFFECTIVE STREAM AREA (ACRES) = STREET FLOW TRAVEL TIME (MIN.) = ELEVATION DATA: UPSTREAM(FEET) = GROUP GROUP Д TOTAL NUMBER OF STREAMS = 2 0.43 LONGEST FLOWPATH FROM NODE AREA-AVERAGED Ap = 0.40 FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ LAND USE RESIDENTIAL

Page 10 *********************** 0.0150 32.00 = 248.00 FEET. AREA-AVERAGED Fm(INCH/HR) = 0.08 0.95 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 Ö UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = 0.30 DEPTH*VELOCITY(FT*FT/SEC.) = 32.00 IS CODE = 62 0.69 (ACRES) (INCH/HR) (DECIMAL) 0.40 32.00 IS CODE = 64.00 CURB HEIGHT (INCHES) = 4.8 9.52 Αp DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH(FEET) = 8.49 FLOW VELOCITY(FEET/SEC.) = 1.21 DEPTH*VELOCITY(FT*FT/SEC LONGEST FLOWPATH FROM NODE 25.00 TO NODE 32.00 = 5.00 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< PEAK FLOW RATE(CFS) = DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = INSIDE STREET CROSSFALL (DECIMAL) = 0.020 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 TC(MIN.) = 0.20 File name: PROP-25.RES SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.30 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: Чр * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.369 1.18 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 HALFSTREET FLOOD WIDTH(FEET) = 8.07
AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.1
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 36.00 TO NODE >>>> (STREET TABLE SECTION # 1 USED) <<<< 32.00 TO NODE 0.10 AREA STREET FLOW TRAVEL TIME (MIN.) = 0.90 END OF SUBAREA STREET FLOW HYDRAULICS: OUTSIDE STREET CROSSFALL (DECIMAL) SCS SOIL STREET FLOW DEPTH(FEET) = 0.25 SUBAREA LOSS RATE DATA(AMC II): GROUP STREET HALFWIDTH (FEET) = 15.00 0.22 0.10 Ω FLOW PROCESS FROM NODE FLOW PROCESS FROM NODE SUBAREA AREA (ACRES) = SUBAREA RUNOFF(CFS) = STREET LENGTH (FEET) == "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ RESIDENTIAL Date: 06/06/11

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

TOTAL NUMBER OF STREAMS = 2

TIME OF CONCENTRATION(MIN.) = 9.52

RAINFALL INTENSITY (INCH/HR) =

AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 0.95

PEAK FLOW RATE (CFS) AT CONFLUENCE =

EFFECTIVE STREAM AREA (ACRES) =

AREA-AVERAGED Ap = 0.40

TOTAL STREAM AREA(ACRES) =

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DEPTH OF FLOW IN 18.0 INCH PIPE IS PIPE-FLOW VELOCITY(FEET/SEC.) = 10..
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         EFFECTIVE AREA(ACRES) = 0.71 AREA-AVERAGED Fm(INCH/HR) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ** CONFLUENCE DATA **
                                                                                                                                                                                                                                                                                                                                                                                           >>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<
                                                                                                                                                                                                                                                                                                                                                                                                                               FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           FLOW LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      ** PEAK FLOW RATE TABLE **
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PIPE TRAVEL TIME (MIN.) = 0.02 Tc (MIN.) = 9.54
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      PIPE-FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              NUMBER
                                                                                      LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                 LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                       ** MAIN STREAM CONFLUENCE DATA **
                                                  ** PEAK FLOW RATE TABLE **
                                                                                                                                                                                                               ** MEMORY BANK # 1 CONFLUENCE DATA **
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               STREAM
                                                                                                                                                                            NUMBER
                                                                                                                                                                                             STREAM
                                                                                                                                                                                                                                                                                                     NUMBER
                                                                                                                                                                                                                                                                                                                       STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STREAM
                                  STREAM
               NUMBER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             2 1
                                                                                                                                           2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Q TC Intensity Fp(Fm) (CFS) (MIN.) (INCH/HR) (INCH/HR)
(CFS) (MIN.) (INCH/HR) (INCH/HR) (6.71 9.54 3.366 0.20(0.08) 0.40
                                                                                                                                                                            (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                                                    (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                2.09 9.52 3.369 0.20( 0.08) 0.40
2.08 10.60 3.166 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             1.19 10.60
0.95 9.52
                                                                                                                                         4.79
                                                                                                                        4.84

    2.09
    9.54
    3.366
    0.20( 0.08)
    0.40
    0.7

    2.08
    10.62
    3.163
    0.20( 0.08)
    0.40
    0.8

                                                                                                                      10.44
10.78
11.25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     2.09
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             10.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Intensity
                                                                                                                                                                                             Intensity
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             3.166 0.20(0.08) 0.40
3.369 0.20(0.08) 0.40
                                  Intensity
                                                                                                                                                                                                                                                                                                                       Intensity
                                                                                                    3.192 0.20( 0.08) 0.40
3.139 0.20( 0.08) 0.40
3.065 0.20( 0.08) 0.40
2.973 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           0.75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              2.09
                                                                                                                                                                                                                                                                                                                                                                                                                               30.00 TO NODE 30.00 IS CODE = 11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    32.00 TO NODE
                                                                                                                                                                                                                                                 21.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  21.00 TO NODE 30.00 = 336.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          MANNING'S N = 0.013
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        21.00 TO NODE
                                                                                      5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         10.30
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Fp (Fm)
                                  Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               67.80 DOWNSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Tc(MIN.) =
                                                                                                                                                                                             Fp (Fm)
                                                                                                                                                                                                                                                                                                                       Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          3.1 INCHES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    30.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                   Αp
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ΑĎ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Αp
                                 Αþ
                                                                                                                                                                                             Αp
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        32.00 =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               (ACRES)
                                                                                      30.00 =
                                                                                                                                                                            (ACRES)
                                                                                                                                                                                                                                                   30.00 =
                                                                                                                                                                                                                                                                                                     (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              9.52
                 (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Ae
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Ae
                                    Аe
                                                                                                                                                                                                                                                                                                                         Аe
                                                                                                                                                                                               Аe
                                                                                                      1.8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.7
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             0.4
                                                                                                                      1.7
1.7
1.8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.8
                                                                                                                                                                                                                                              .7 25.00
.8 21.00
: 336.00 FEET.
                                    HEADWATER
                                                                                      507.00 FEET
                                                                                                                                                                                               HEADWATER
                                                                                                                                                                                                                                                                                                                         HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          326.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 NODE
                                                                                                                                                                               NODE
                                                                                                                                                                                                                                                                                                       NODE
                    NODE
                                                                                                                        25.00
21.00
5.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  25.00
21.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            21.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              25.00
 25.00
                                                                                                          1.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               66.80
```

	TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.237 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.434 SUBAREA TC AND LOSS RATE DATA(AMC II):
	>>USE TIME-OF CONCENTRATION NOWGERPH FOR INITIAL SUBAREA<

	ARI A (AC FS)
	NCENTRATION (MIN.) = 10.87 NTENSITY (INCH/HR) = 3.12 SED PR(INCH/HR) = 0.08 SED PR(INCH/HR) = 0.20 SED PR(INCH/HR) = 0.20
	TOTAL NUMBER OF STREAMS = 3 CONFILINCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
	FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1
	PIPE TRAVEL TIME(MIN.) LONGEST FLOWPATH FROM N
	TY(FEET/SEC.) = 5.2 IAMETER(INCH) = 18.0 6.90
	ELEVATION DATA: UPSTREAM(FEET) = 66.80 DOWNSTREAM(FEET) = 66.60 FLOW LENGTH(FEET) = 30.00 MANNING'S N = 0.013 DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.5 INCHES
	>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<

	# 1 ^^^^

	TOTAL AREA (ACRES) = 2.54 LONGEST FLOWPATH FROM NODE 5.00 TO NODE 30.00 = 507.00 FEET.
	CE ESTIN S) = RES) = INCH/HR
	AL AREA(ACRES) = 2.54
	6.86 11.25 3.065 0.20(0.08) 0.40 2.5 6.71 11.84 2.973 0.20(0.08) 0.40 2.5
	.89 10.62 3.163 0.20(0.08) 0.40 2.5 .90 10.78 3.139 0.20(0.08) 0.40 2.5
	6.87 10.44 3.192 0.20(0.08) 0.40 2.4 25
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************************* 9.24 0.0150 68.00 307.00 FEET. HALFSTREET FLOOD WIDTH(FEET) = 8.84 SEC.) = 1.38 DEPTH*VELOCITY(FT*FT/SEC.) = 0.37 EFFECTIVE AREA (ACRES) = 0.42 AREA-AVERAGED FM (INCH/HR) = 0.08 AREA-AVERAGED Ap = 0.401.16 SCS CN 75 UPSTREAM ELEVATION(FEET) = 68.53 DOWNSTREAM ELEVATION(FEET) = S 0.0199 STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 FLOW PROCESS FROM NODE 42.00 TO NODE 42.00 IS CODE = 81 0.52 42.00 IS CODE = 62 0.69 (ACRES) (INCH/HR) (DECIMAL) AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 0.40 0.40 115.00 CURB HEIGHT(INCHES) = 4.8 Αp Ap Tc(MIN.) = 10.71 42.00 = SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< PEAK FLOW RATE(CFS) = DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.30
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.33 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.149 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.149 1.00 TO NODE OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 41.00 TO NODE >>>> (STREET TABLE SECTION # 1 USED) <<<< 0.23 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.19 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA 1.47 AREA END OF SUBAREA STREET FLOW HYDRAULICS: DEPTH(FEET) = 0.27 HALFSTREET FLOFOW VELOCITY(FEET/SEC.) = 1.38 STREET FLOW DEPTH(FEET) = 0.26 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL SCS SOIL HALFSTREET FLOOD WIDTH(FEET) = STREET FLOW TRAVEL TIME (MIN.) = 0.69 STREET HALFWIDTH (FEET) = 15.00 GROUP 0.19 GROUP 0.23 Д Ω 0.42 LONGEST FLOWPATH FROM NODE MAINLINE TC(MIN) = 10.71 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = STREET LENGIH (FEET) = "8-10 DWELLINGS/ACRE" SUBAREA AREA (ACRES) = "8-10 DWELLINGS/ACRE" TOTAL AREA(ACRES) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ LAND USE RESIDENTIAL RESIDENTIAL

(DECIMAL)

(ACRES) (INCH/HR)

GROUP

LAND USE

APARTMENTS

0.20

0.20

0.07

Page 14 (MIM) ********************* ************************************ 68.18 40.00 = 372.00 FEET. EFFECTIVE AREA (ACRES) = 0.49 AREA-AVERAGED Fm (INCH/HR) = 0.07 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.37 (ACRES) (INCH/HR) (DECIMAL) CN FLOW PROCESS FROM NODE 42.00 TO NODE 40.00 IS CODE = 31 40.00 IS CODE = 1 5.00 TO NODE 45.00 IS CODE = 21 45.00 TO NODE 46.00 IS CODE = 62 1.21 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<< INITIAL SUBAREA FLOW-LENGTH(FEET) = 253.00
ELEVATION DATA: UPSTREAM(FEET) = 70.00 DOWNSTREAM(FEET) = 68.00 DOWNSTREAM(FEET) = 0.40 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Ap SUBAREA AVERAGE PERVIOUS AREA FRACTION, AD = 0.20 SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = "8-10 DWELLINGS/ACRE" D 0.40 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE << < < CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<< 0.21 TC(MIN.) = 10.92 FLOW LENGTH (FEET) = 65.00 MANNING'S N = 0.013 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 File name: PROP-25.RES 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 Tc = K*[(LENGTH**_3.00)/(ELEVATION CHANGE)]**0.20 3.7 INCHES SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.17 * 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.448 SUBAREA TC AND LOSS RATE DATA(AMC II); 1.36 1.00 TO NODE 40.00 TO NODE AREA PIPE-FLOW VELOCITY (FEET/SEC.) = 5.27 EFFECTIVE STREAM AREA (ACRES) = 0.49 DEPTH OF FLOW IN 18.0 INCH PIPE IS TIME OF CONCENTRATION (MIN.) = 10.92 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.49 AREA-AVERAGED FM(INCH/HR) = 0.07 AREA-AVERAGED Fp(INCH/HR) = 0.20 ELEVATION DATA: UPSTREAM(FEET) = SCS SOIL GROUP 1.21 EFFECTIVE AREA(ACRES) = 0.07
AREA-AURPACTO RAINFALL INTENSITY (INCH/HR) = 0.40 0.49 TOTAL NUMBER OF STREAMS = 3 LONGEST FLOWPATH FROM NODE TOTAL STREAM AREA (ACRES) = 1.36 FLOW PROCESS FROM NODE PIPE TRAVEL TIME (MIN.) = FLOW PROCESS FROM NODE AREA-AVERAGED Ap = 0.37 FLOW PROCESS FROM NODE SUBAREA RUNOFF (CFS) = TOTAL AREA (ACRES) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ PIPE-FLOW(CFS) = RESIDENTIAL Date: 06/06/11

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SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = 0.20
SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(C
EFFECTIVE AREA(ACRES) = 0.57 AREA-AVERAGED FM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    FLOW PROCESS FROM NODE 46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Manning's FRICTION FACTOR for Streetflow Section(cuxb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.01s
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<><>>>>> (STREET TABLE SECTION # 1 USED) <<<<>
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
                        >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
                                                                                  FLOW PROCESS FROM NODE
                                                                                                                                                                 TOTAL AREA(ACRES) =
                                                                                                                                                                                    EFFECTIVE AREA(ACRES) = 0.57 AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.38
                                                                                                                                                                                                                                                                                                       SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                         SUBAREA LOSS RATE DATA (AMC DEVELOPMENT TYPE/ SCS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              MAINLINE TC (MIN) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = 8.00 FLOW VELOCITY(FEET/SEC.) = 2.09 DEPTH*VELOCITY(FT*FT/SEC.) = 0.53
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       TOTAL AREA(ACRES) = 0.50
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
SUBAREA AREA(ACRES) = 0.10
SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       RESIDENTIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SUBAREA LOSS RATE DATA (AMC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREET FLOW TRAVEL TIME (MIN.) = 0.47
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         STREET PARKWAY CROSSFALL (DECIMAL) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            STREET HALFWIDTH (FEET) = 15.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          STREET FLOW DEPTH(FEET) = 0.25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.341
                                                                                                                                                                                                                                                                                                                                                                                                                                                25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.341
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LAND USE
                                                                                                                                                                                                                                                                                                                                                                    LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              9.64
                                                                                                                                                                 0.57
                                                                                                                                                                                                                                                                                                                                                                                            SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       57.00 CURB HEIGHT (INCHES) = 4.8
                                                                                                                                                                                                                                                                                                                                                                 GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GROUP
                                                                                  46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           0.50
                                                                                                                                                                                                                                                                                                                                     U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      II):
                                                                                                                                                                                                                                                                                                                                                                                                                        II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             AREA FP (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                              (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           AREA
                                                                                                                                                                 PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                            AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                   SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                     0.07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 2.04
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Tc(MIN.) = 9.64
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         46.00 IS CODE = 81
                                                                               40.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           0.50
                                                                                                                                                                                                                                                                                                                                                                                         Fρ
                                                                                                                                                                                                                                                                                                                                     0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           46.00 = 310.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Ap
(DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     5.00
                                                                                                                                                                                                                                                                                                                                     0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               1.36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.0199
                                                                                                                                                                                                                                                   0.21
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.29
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             CN
SCS
                                                                                                                                                                 1.68
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.47
                                                                                                                                                                                                                                                                                                                                                           Q
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     67.50
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************************ >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.0 INCHES TIME OF CONCENTRATION(MIN.) = 9.76
RAINFALL INTENSITY(INCH/HR) = 3.31 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE: FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE PIPE-FLOW(CFS) = 1.0
PIPE TRAVEL TIME(MIN.) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = PIPE-FLOW VELOCITY (FEET/SEC.) = 5.70 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 ELEVATION DATA: UPSTREAM(FEET) = LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = PEAK FLOW RATE(CFS) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: ** PEAK FLOW RATE TABLE ** CONFLUENCE FORMULA USED FOR 3 STREAMS. RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO ** CONFLUENCE DATA ** PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA(ACRES) = EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED AP = AREA-AVERAGED Fp(INCH/HR) = 0.20AREA-AVERAGED Fm(INCH/HR) = 0.08 TOTAL NUMBER OF STREAMS = 3 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< FLOW LENGTH (FEET) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39 NUMBER STREAM NUMBER STREAM (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) 9.83 10.87 9.82 10.92 9.72 11.34 9.49 11.93 9.81 9.66 9.70 6.71 6.86 6.90 6.89 6.87 6.71 0 9.63 10.53 10.71 11.93 10.92 10.87 9.63 9.76 10.53 10.71 11.34 Ľ. 0.38 1.68 40.00 Intensity Intensity 3.314 0.20 (0.08) 0.39 3.177 0.20 (0.08) 0.39 3.149 0.20 (0.08) 0.39 3.144 0.20 (0.08) 0.39 3.117 0.20 (0.08) 0.39 3.051 0.20 (0.08) 0.39 2.958 0.20 (0.08) 0.39 3.149 0.20(0.08) 0.40 3.124 0.20(0.08) 0.40 3.051 0.20(0.08) 0.40 2.958 0.20(0.08) 0.40 3.117 0.20(0.07) 0.37 3.314 0.20(0.08) 0.38 3.60 3.344 0.20(0.08) 0.40 3.177 0.20(0.08) 0.40 40.00 TO NODE 0.12 3.344 9.83 3.53 AREA-AVERAGED Fm(INCH/HR) = 0.08 0.57 MANNING'S N = 0.0135.00 TO NODE 5.00 TO NODE 0.20(0.08) 0.39 (INCH/HR) 0.57 Fp (Fm) Tc(MIN.) = Fp (Fm) Tc(MIN.) = 67.50 DOWNSTREAM(FEET) = 1.68 40.00 IS CODE = 1 Αp Αþ 9.76 40.00 = 537.00 FEET. 40.00 = 10.87 (ACRES) (ACRES) Аe Аe 0.5555.2 HEADWATER 350.00 FEET HEADWATER NODE NODE 21.00 5.00 1.00 1.00 5.00 25.00 21.00 21.00 25.00 25.00 21.00 1.00 5.00 1.00 5.00 25.00 66.60

FLOW PROCESS FROM NODE

40.00 TO NODE

50.00 IS CODE = 31

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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<>>>
ELEVATION DATA: UPSTREAM (FEET) = 66.60 DOWNSTREAM (FEET) = 65.30

FLOW LENGTH (FEET) = 330.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 24.0 INCH PIPE IS 14.9 INCHES

PIPE-FLOW VELOCITY (FEET/SEC.) = 4.78

ESTIMATED PIPE DIAMETER (INCH) = 24.00 NUMBER OF PIPES = 1

PIPE-FLOW (CFS) = 9.83

PIPE-FLOW (CFS) = 1.15

TC (MIN.) = 1.1.02

LONGEST FLOWPATH FROM NODE 5.00 TO NODE 50.00 = 867.00 FEET.

BIND OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 3.60 TC (MIN.) = 12.02

EFFECTIVE AREA (ACRES) = 3.53 AREA-AVERAGED FM (INCH/HR) = 0.08

AREA-AVERAGED FD (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39

PEAK FLOW RATE (CFS) = 9.83

** PEAK FLOW RATE TABLE **

STREM Q TC Intensity Fp(Fm) Ap Ae HEADWATER

NUMBER (CFS) (MIN.) (INCH/HR) (ACRES) NODE

1 9.66 10.83 3.131 0.20(0.08) 0.39 3.3 25.00

2 9.70 10.91 3.117 0.20(0.08) 0.39 3.5 25.00

4 9.83 11.68 2.998 0.20(0.08) 0.39 3.5 25.00

5 9.83 12.02 2.944 0.20(0.08) 0.39 3.5 21.00

6 9.82 12.07 2.948 0.20(0.08) 0.39 3.5 21.00

7 9.72 12.49 2.918 0.20(0.08) 0.39 3.5 1.00

8 9.49 13.13 2.998 0.20(0.08) 0.39 3.5 1.00

END OF RATIONAL METHOD ANALYSIS

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
                                                                (Reference: 1986 OCEMA HYDROLOGY CRITERION)
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Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\PRP-100.DAT USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: --*TIME-OF-CONCENTRATION MODEL*--TIME/DATE OF STUDY: 09:20 06/06/2011

SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD* USER SPECIFIED STORM EVENT(YEAR) = 100.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 *DATA BANK RAINFALL USED*

1.00 0.0312 0.080 0.0150 Ê *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* HIKE CURB GUTTER-GEOMETRIES: (FT) (FI) HEIGHT WIDTH LIP (FT) 0.40 (FI) STREET-CROSSFALL: 0.020/0.020/0.020 IN- / OUT-/PARK-SIDE / SIDE/ WAY CROSSFALL HALF- CROWN TO 5.0 (FT) 1 15.0

USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED 1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) 2. (Depth)(Velocity) Constraint = 6.0 (FY*FY/S)
SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE. GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

(MIN.) 9.17 ************************ 3 SCS 2.00 IS CODE = 21 0.93 (ACRES) (INCH/HR) (DECIMAL) 69.30 DOWNSTREAM(FEET) = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 PEAK FLOW RATE (CFS) = 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.372 INITIAL SUBAREA FLOW-LENGTH(FEET) = 192.00 FLOW PROCESS FROM NODE 1.00 TO NODE SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 0.24 SUBAREA TC AND LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA ELEVATION DATA: UPSTREAM(FEET) = 0.93 GROUP 0.24 Д SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = LAND USE RESIDENTIAL

5.00 TO NODE

FLOW PROCESS FROM NODE

1.62

PEAK FLOW RATE(CFS) AT CONFLUENCE ==

0.47

EFFECTIVE STREAM AREA(ACRES) =

AREA-AVERAGED Ap = 0.40

TOTAL STREAM AREA(ACRES) =

0.47

6.00 IS CODE = 21

FLOW VELOCITY(FEET/SEC.) = 1.37 DEPTH*VELOCITY(FT*FT/SEC.) =

1.00 TO NODE

LONGEST FLOWPATH FROM NODE

FLOW PROCESS FROM NODE

DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 10.59

END OF SUBAREA STREET FLOW HYDRAULICS:

10.00 TO NODE 10.00 IS CODE = 1

10.00 = 356.00 FEET.

AREA-AVERAGED Fm(INCH/HR) = 0.08

 $\label{eq:precine} \begin{array}{llll} \text{EFFECTIVE AREA}(\text{ACRES}) &=& 0.47 & \text{AREA-AVERAGED Fm}(\text{INCH/HR}) \\ \text{AREA-AVERAGED Fp}(\text{INCH/HR}) &=& 0.20 & \text{AREA-AVERAGED Ap} &=& 0.40 \\ \text{TOTAL AREA}(\text{ACRES}) &=& 0.47 & \text{PEAK FLOW RATE}(\text{CFS}) &=& \\ \end{array}$

SUBAREA RUNOFF (CFS) = 0.79

0.23

SUBAREA AREA(ACRES) =

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TOTAL NUMBER OF STREAMS = 2

TIME OF CONCENTRATION(MIN.) = 11.26 RAINFALL INTENSITY (INCH/HR) = 3.91

AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<

0.0150 67.90 SCS S Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 UPSTREAM ELEVATION(FEET) = 68.50 DOWNSTREAM ELEVATION(FEET) = STREET LENGTH(FEET) = 164.00 CURB HEIGHT(INCHES) = 4.8 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp 10.00 IS CODE DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 Tc(MIN.) = 11.26 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.908 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.31 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = = 0.020 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< 2.00 TO NODE INSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.23 9.75 AREA 2.09 OUTSIDE STREET CROSSFALL (DECIMAL) STREET FLOW DEPTH(FEET) = 0.29 SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL STREET FLOW TRAVEL TIME (MIN.) = GROUP STREET LENGTH (FEET) = 164.00 STREET HALFWIDTH (FEET) = 15.00 Д FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE"

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UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) = 67.90
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/Hr) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.17
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.403
                                                                                                                                                           O.67

AREA-AVERAGED FM (INCH/HR) = 0.58

AREA-AVERAGED FM (INCH/HR) = 0.20

AREA-AVERAGED Ap = 0.40

TOTAL AREA(ACRES) = 0.58

PEAK FILM DAMM (ACRES)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               STREET HALFWIDTH (FEET) = 15.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        STREET LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SUBAREA TC AND LOSS RATE DATA(AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            INITIAL SUBAREA FLOW-LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<
                                                LONGEST FLOWPATH FROM NODE
                                                                       FLOW VELOCITY (FEET/SEC.) = 1.24
                                                                                                DEPTH(FEET) = 0.34
                                                                                                                            END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                               SUBAREA AREA(ACRES) = EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                            SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                           SUBAREA LOSS RATE DATA (AMC II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                    * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.019
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                INSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  >>>> (STREET TABLE SECTION # 1 USED) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    SUBAREA RUNOFF (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
                                                                                                                                                                                                                                                                                                                                        "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                  DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    STREET FLOW DEPTH(FEET) = 0.33
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   LAND USE
                                                                                                                                                                                                                                                                                                                                                                                           LAND USE
                                                                                              HALFSTREET FLOOD WIDTH (FEET) = 12.62
                                                                                                                                                                                                                                                 0.19
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     112.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          0.39 PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                  SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   GROUP
                                                                                                                                                                                                                                                                                                                                                                                           GROUP
                                                                                                                                                                                                                                                                                                                                          U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    1.52
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              6.00 TO NODE
                                                5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        CURB HEIGHT (INCHES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (ACRES) (INCH/HR) (DECIMAL) CN
                                                                                                                                                                                                                                                                                                                                                                                        (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              1.53
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          12.07
                                                                       DEPTH*VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                  AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             AREA
                                                                                                                                                                                                                                                         SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.39
                                                                                                                                                                                                                                                                                                                                        0.19
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     70.00 DOWNSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               253.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         Tc(MIN.) = 10.71
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      9.178
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              10.00 IS CODE = 62
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          Fρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       0.41
                                                                                                                                                                                                                                                                                                                                                                                                               Ęρ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.20
                                                                                                                                                                                                                                                                                                                                        0.20
                                                10.00 =
                                                                                                                                                                                                                                                                                                                                                                                           (DECIMAL) CN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            5.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.40
                                                                                                                                                                                                                                                                                                                                        0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Αp
                                                                                                                                                                                                                                                                                                                                                                                                               Αp
                                                365.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          1.52
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       1.85
                                                                                                                                                                                                                                                                                                                                          75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                75
                                                                            0.43
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   68.18
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   (MIN.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                9.18
```

************************ ********************* DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.18
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< FLOW PROCESS FROM NODE >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< PEAK FLOW RATE (CFS) AT CONFLUENCE = AREA-AVERAGED fp(INCH/HR) = 0.20RAINFALL INTENSITY (INCH/HR) = TIME OF CONCENTRATION(MIN.) = 10.71 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: TOTAL NUMBER OF STREAMS = 2 TIME OF CONCENTRATION(MIN.) = 10.81
RAINFALL INTENSITY(INCH/HR) = 4.00 FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 3.64 TC(MIN.) = CONFLUENCE FORMULA USED FOR 2 STREAMS. RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO TOTAL STREAM AREA(ACRES) = EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fm(INCH/HR) = AREA-AVERAGED Fm(INCH/HR) = 0.08CONFLUENCE VALUES USED FOR INDEPENDENT STREAM TOTAL NUMBER OF STREAMS = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE < < < < FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 ** CONFLUENCE DATA ** NUMBER STREAM ** PEAK FLOW RATE TABLE ** NUMBER STREAM 2 1 (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 3.64 10.71 4.019 0.20(0.08) 0.40 1.0 3.62 11.26 3.908 0.20(0.08) 0.40 1.0 1.62 11.26 3.908 0.20(0.08) 0.40 0.5 2.06 10.71 4.019 0.20(0.08) 0.40 0.6 Ø 3.64 Intensity 32.00 Intensity 1.05 0.10 10.00 TO NODE 20.00 IS CODE = 31 20.00 TO NODE 1.03 AREA-AVERAGED Fm(INCH/HR) = 0.08 10.00 TO NODE 0.58 0.08 5.00 TO NODE MANNING'S N = 0.013 4.02 5.00 TO NODE 0.58 Tc(MIN.) = 10.81Fp (Fm) Tc(MIN.) = Fp (Fm) 67.90 DOWNSTREAM (FEET) = 2.06 10.00 IS CODE = 20.00 IS CODE = Αp Αp 20.00 = 397.00 FEET. 10.00 = 365.00 FEET 10.71 (ACRES) (ACRES) Аe Аe HEADWATER HEADWATER NODE NODE سر 1.00 1.00 5.00 5.00 67.60

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3.64 PEAK FLOW RATE (CFS) AT CONFLUENCE = EFFECTIVE STREAM AREA (ACRES) = TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

AREA-AVERAGED Fp(INCH/HR) = 0.20

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 21

INITIAL SUBAREA FLOW-LENGTH (FEET) = 186.00

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<

(MIN.) 68,36 Ę (ACRES) (INCH/HR) (DECIMAL) CN 0.88 69.30 DOWNSTREAM(FEET) = 0.40 Αp SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 Fр * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.542 0.22 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = SUBAREA TC AND LOSS RATE DATA(AMC II): AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = 0.88 GROUP 0.22 Д SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/

******************************* FLOW PROCESS FROM NODE 22.00 TO NODE 20.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<

>>>> (STREET TABLE SECTION # 1 USED) <<<<

67.90 UPSTREAM ELEVATION(FEET) = 68.36 DOWNSTREAM ELEVATION(FEET) = 126.00 CURB HEIGHT(INCHES) = 4.8 STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH (FEET) =

5.00 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020 INSIDE STREET CROSSFALL (DECIMAL) = 0.020

0.0150 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

(ACRES) (INCH/HR) (DECIMAL) Αp Tc(MIN.) = 10.35**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = Fр STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.090 1.28 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 9.47 STREET FLOW TRAVEL TIME (MIN.) = 1.64 AREA AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET FLOW DEPTH(FEET) = 0.28 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = GROUP

0.40 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Pp(INCH/HR) = 0.20 0.20 0.19 Д "8-10 DWELLINGS/ACRE"

AREA-AVERAGED Fm(INCH/HR) = 0.08

0.41

EFFECTIVE AREA (ACRES) =

0.69

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1.48 0.40 PEAK FLOW RATE(CFS) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap 0.41 TOTAL AREA (ACRES) =

END OF SUBAREA STREET FLOW HYDRAULICS:

20.00 = 312.00 FEET. DEPTH*VELOCITY(FT*FT/SEC.) = 0.39 DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 10.27 21.00 TO NODE FLOW VELOCITY(FEET/SEC.) = 1.33 LONGEST FLOWPATH FROM NODE *********************** FLOW PROCESS FROM NODE 20.00 TO NODE 20.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: TIME OF CONCENTRATION(MIN.) = 10.35
RAINFALL INTENSITY(INCH/HR) = 4.09 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 TOTAL NUMBER OF STREAMS = 3

26.00 IS CODE = 21 25.00 TO NODE FLOW PROCESS FROM NODE

1.48

PEAK FLOW RATE (CFS) AT CONFLUENCE =

EFFECTIVE STREAM AREA(ACRES) = TOTAL STREAM AREA(ACRES) = 0.41

AREA-AVERAGED Ap = 0.40

0.41

0.41

68.04 69.00 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< INITIAL SUBAREA FLOW-LENGTH (FEET) = 185.00

ELEVATION DATA: UPSTREAM(FEET) =

TC (MIN.) SCS (ACRES) (INCH/HR) (DECIMAL) ďγ Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.561 Fр SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = AREA SUBAREA TC AND LOSS RATE DATA(AMC II): SCS SOIL GROUP DEVELOPMENT TYPE/

0.89 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.22 0.89 0.22 Д "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = TOTAL AREA(ACRES) = ************************* 20.00 IS CODE = 62 26.00 TO NODE FLOW PROCESS FROM NODE

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< >>>> (STREET TABLE SECTION # 1 USED) <<<< UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = 67.90

78.00

STREET HALFWIDTH (FEET) = 15.00

STREET LENGTH (FEET) =

CURB HEIGHT (INCHES) = 4.8

5.00 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = INSIDE STREET CROSSFALL (DECIMAL) = 0.020 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020

STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

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1.77
                                          File name: PRP-100.RES
AREA-AVERAGED Fm(INCH/HR) = 0.08
                                        Page 8
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************************ LONGEST FLOWPATH FROM NODE >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE 20.00 TO NODE TOTAL AREA (ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 EFFECTIVE AREA(ACRES) = 1.79 5.00 TO NODE 30.00 IS CODE = 31 20.00 = 397.00 FEET

LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = PIPE-FLOW VELOCITY (FEET/SEC.) = 6.08 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.2 INCHES ELEVATION DATA: UPSTREAM(FEET) = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = 110.00 6.25 0.30 MANNING'S N = 0.0135.00 TO NODE Tc(MIN.) = 11.1167.90 DOWNSTREAM(FEET) = 30.00 = 507.00 FEET 66.80

FLOW PROCESS FROM NODE 30.00 TO NODE 30.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 21.00 TO NODE 31.00 IS CODE = 21 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS < < < <

20.00 IS CODE = 1

25.00 TO NODE

FLOW PROCESS FROM NODE 20.00 TO NODE

LONGEST FLOWPATH FROM NODE

FLOW VELOCITY (FEET/SEC.) = 0.97

DEPTH(FEET) = 0.31

HALFSTREET FLOOD WIDTH(FEET) = 10.90

DEPTH*VELOCITY(FT*FT/SEC.) = 0.30

20.00 =

263.00 FEET

END OF SUBAREA STREET FLOW HYDRAULICS:

EFFECTIVE AREA(ACRES) = 0.33 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 TOTAL AREA(ACRES) = 0.33 PEAK FLOW RATE(CFS) = 1.21

SUBAREA AREA (ACRES) =

"8-10 DWELLINGS/ACRE"

U

0.11

0.20

0.40

75

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20

0.11

SUBAREA RUNOFF(CFS) =

0.40

SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/

SCS SOIL GROUP

AREA

Ę

Αp

(ACRES) (INCH/HR) (DECIMAL) CN

LAND USE

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.157

STREET FLOW TRAVEL TIME (MIN.) =

1.37

TC (MIN.) =

10.02

0.28

10.43

0.95

PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = AVERAGE FLOW VELOCITY (FEET/SEC.) = HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW DEPTH(FEET) = 0.30 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS)

1.09

TOTAL NUMBER OF STREAMS =

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE < < < <

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:

PEAK FLOW RATE (CFS) AT CONFLUENCE =

TOTAL STREAM AREA(ACRES) = EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40

0.33

1.21

0.33

** CONFLUENCE DATA **

NUMBER

3.62 1.48 1.21 3.64

11.36 10.35 10.02 10.81 Tc

3.998 0.20(0.08) 0.40 3.887 0.20(0.08) 0.40 4.090 0.20(0.08) 0.40 4.157 0.20(0.08) 0.40

1.0 1.0 0.4 0.3

21.00

(CFS) (MIN.) (INCH/HR) (INCH/HR)

Intensity

Fp(Fm)

Αp

HEADWATER

(ACRES) Ãе

NODE

1.00

STREAM

AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20

RAINFALL INTENSITY (INCH/HR) = TIME OF CONCENTRATION(MIN.) = 10.02

4.16

ELEVATION DATA: UPSTREAM(FEET) = INITIAL SUBAREA FLOW-LENGTH (FEET) = 186.00 69.30 DOWNSTREAM(FEET) 68.39

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

SUBAREA TC AND LOSS RATE DATA (AMC II): * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.525 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.208.765

RESIDENTIAL TOTAL AREA(ACRES) = SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/ LAND USE SCS SOIL 0.22 GROUP U 0.88 PEAK FLOW RATE(CFS) = (ACRES) (INCH/HR) AREA 0.22 Fρ 0.20 (DECIMAL) 0.40 Αp 0.88 CN 75 (MIN.) 8.77

********************************* FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 62

>>>> (STREET TABLE SECTION # 1 USED) <<<<< >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<

CONFLUENCE FORMULA USED FOR 3 STREAMS

** PEAK FLOW RATE TABLE **

NUMBER STREAM

(CFS) (MIN.) (INCH/HR) (INCH/HR)

Tc

Intensity

Fp(Fm)

Α̈́ρ

Аe

HEADWATER

(ACRES)

NODE

25.00

6.18 10.02 6.24 10.35 6.25 10.81 6.15 11.36

4.157 0.20(0.08) 0.40 4.090 0.20(0.08) 0.40 3.998 0.20(0.08) 0.40 3.887 0.20(0.08) 0.40

1.7 1.7 1.8 1.8

21.00 5.00 1.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO

STREET HALFWIDTH(FEET) = 15.00 STREET LENGTH(FEET) = UPSTREAM ELEVATION(FEET) = 68.39 DOWNSTREAM ELEVATION(FEET) = 140.00 CURB HEIGHT (INCHES) = 4.8

OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 INSIDE STREET CROSSFALL (DECIMAL) = 0.020 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 6.25 Tc(MIN.) =

10.81

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

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Page 9 8.62 (MIN.) Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 68.04 32.00 = 326.00 FEET. DEPTH*VELOCITY(FT*FT/SEC.) = 0.42 AREA-AVERAGED Fm(INCH/HR) = 0.08 1.54 (ACRES) (INCH/HR) (DECIMAL) CN S 75 FLOW PROCESS FROM NODE 32.00 TO NODE 32.00 IS CODE = 1 36.00 IS CODE = 21 (ACRES) (INCH/HR) (DECIMAL) 69.00 DOWNSTREAM(FEET) = 0.40 0.40 EFFECTIVE AREA(ACRES) = 0.43 AREA-AVERAGED FM(INCH/HR) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH (FEET) = 0.29 HALFSTREET FLOOD WIDTH (FEET) = 10.12

FLOW VELOCITY (FEET/SEC.) = 1.42 DEPTH*VELOCITY (FT*FT/SEC Tc(MIN.) = 10.50SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.21 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.20 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 8.616 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.37 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: Бp * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.570 чр * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.061 1.54 1.35 21.00 TO NODE INITIAL SUBAREA FLOW-LENGTH(FEET) = 184.00 0.020 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 0.22 25.00 TO NODE 0.21 9.33 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA SUBAREA TC AND LOSS RATE DATA(AMC II); AREA 1.73 EFFECTIVE STREAM AREA (ACRES) = 0.43 AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET PARKWAY CROSSFALL (DECIMAL) = TIME OF CONCENTRATION(MIN.) = 10.50 RAINFALL INTENSITY(INCH/HR) = 4.06 PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.43 AREA-AVERAGED Fm(INCH/HR) = 0.08 STREET FLOW DEPTH(FEET) = 0.28 AREA-AVERAGED Fp(INCH/HR) = 0.20 SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = STREET FLOW TRAVEL TIME (MIN.) = GROUP GROUP Ω Д TOTAL NUMBER OF STREAMS = 2 0.43 TOTAL STREAM AREA(ACRES) = LONGEST FLOWPATH FROM NODE AREA-AVERAGED Ap = 0.40 FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE" '8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ TAND IISE Date: 06/06/11

32.00 TO NODE

FLOW PROCESS FROM NODE

32,00 IS CODE = 1

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

TOTAL NUMBER OF STREAMS = 2

TIME OF CONCENTRATION(MIN.) = 9.47
RAINFALL INTENSITY(INCH/HR) = 4.32

AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Fm(INCH/HR) = 0.08

AREA-AVERAGED Ap = 0.40

1.22

PEAK FLOW RATE(CFS) AT CONFLUENCE =

EFFECTIVE STREAM AREA(ACRES) = TOTAL STREAM AREA(ACRES) = 0.

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<

Page 10 ***************************** 0.0150 UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = 67.80 248.00 FEET. AREA-AVERAGED Fm(INCH/HR) = 0.08 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SCS DEPTH (FEET) = 0.28 HALFSTREET FLOOD WIDTH (FEET) = 9.40 FLOW VELOCITY (FEET/SEC.) = 1.29 DEPTH*VELOCITY (FT*FT/SEC.) = 32.00 IS CODE = 62 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) 0.40 EFFECTIVE AREA (ACRES) = 0.32 AREA-AVERAGED FM (INCH/HR)
AREA-AVERAGED PP (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA (ACRES) = 0.32 PEAK FLOW RATE (CFS) = 64.00 CURB HEIGHT (INCHES) = 4.8 STREET FLOW TRAVEL TIME(MIN.) = 0.86 Tc(MIN.) = 9.47 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 INSIDE STREET CROSSFALL(DECIMAL) = 0.020 32.00 = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA (ACRES) = 0.10 SUBAREA RUNOFF (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = File name: PRP-100.RES PEAK FLOW RATE(CFS) 0.20 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.34 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.316 1.24 25.00 TO NODE OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 36.00 TO NODE >>>> (STREET TABLE SECTION # 1 USED) <<<< 8.98 0.10 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA END OF SUBAREA STREET FLOW HYDRAULICS: AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET FLOW DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH (FEET) = GROUP STREET HALFWIDTH (FEET) = 15.00 Ω LONGEST FLOWPATH FROM NODE FLOW PROCESS FROM NODE STREET LENGTH (FEET) = "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) LAND USE RESIDENTIAL Date: 06/06/11

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************************************ ****************** DEPTH OF FLOW IN 18.0 INCH PIPE IS :
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.10 EFFECTIVE AREA(ACRES) = RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS. LONGEST FLOWPATH FROM NODE ** MEMORY BANK # 1 CONFLUENCE DATA ** LONGEST FLOWPATH FROM NODE ** MAIN STREAM CONFLUENCE DATA ** >>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY< FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<< FLOW PROCESS FROM NODE 32.00 TO NODE LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = EFFECTIVE AREA(ACRES) = 0.71 AREA-AVERAGED Fm(INCH/HR) AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 PEAK FLOW RATE (CFS) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: ** PEAK FLOW RATE TABLE ** ** CONFLUENCE DATA ** ** PEAK FLOW RATE TABLE ** NUMBER NUMBER STREAM NUMBER NUMBER STREAM NUMBER STREAM STREAM STREAM 3 2 1 2 1 (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 6.18 10.32 6.24 10.65 6.25 11.11 6.15 11.66 (CFS) (MIN.) (INCH/HR) (INCH/HR) (8.68 9.49 4.311 0.20(0.08) 0.40 (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 2.70 9.47 4.316 0.20(0.08) 0.40 0.7 2.69 10.50 4.061 0.20(0.08) 0.40 0.8
 2.70
 9.49
 4.311
 0.20(0.08) 0.40
 0.7

 2.69
 10.51
 4.058
 0.20(0.08) 0.40
 0.8
 1.22 9.47 1.54 10.50 Tc TC Intensity Fp(Fm) 2.70 Intensity Intensity Intensity 10.00 4.061 0.20(0.08) 0.40 4.316 0.20(0.08) 0.40 Intensity 4.096 0.20(0.08) 0.40 4.030 0.20(0.08) 0.40 3.938 0.20(0.08) 0.40 3.827 0.20(0.08) 0.40 2.70 0.75 0.02 Tc(MIN.) = 9.4930.00 TO NODE MANNING'S N = 0.013 21.00 TO NODE 21.00 TO NODE 21.00 TO NODE 5.00 TO NODE AREA-AVERAGED Fm(INCH/HR) = 0.08 Fp (Fm) Fp (Fm) Tc(MIN.) = Fp(Fm) Fp(Fm) 67.80 DOWNSTREAM (FEET) = 3.5 INCHES 30.00 IS CODE = 31 30.00 IS CODE = 11 Αp Αp Αp Αp Αp 30.00 = 336.00 FEET. 32.00 = (ACRES) (ACRES) (ACRES) 30.00 = (ACRES) 30.00 = (ACRES) 9.47 Аe Аe Аe Аe 1.7 1.7 1.8 0.4 1.8 7 25.00 8 21.00 336.00 FEET. HEADWATER HEADWATER HEADWATER HEADWATER HEADWATER 507.00 FEET 326.00 FEET NODE NODE NODE NODE NODE 1.00 25.00 21.00 25.00 21.00 25.00 21.00 25.00 66.80

	TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.237 * 100 YEAR RAIMFALL INTENSITY(INCH/HR) = 4.386 SUBAREA TC AND LOSS RATE DATA(AMC II):
	>RATIONAL METHOD INITIAL SUBARBA ANALYSIS<

	TOTAL NUMBER OF STREAMS = 3 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: TIME OF CONCENTRATION(MIN.) = 10.74 RAINFALL INVENSITY(INCH/HR) = 4.01 AREA-AVERAGED FM(INCH/HR) = 0.08 AREA-AVERAGED FD(INCH/HR) = 0.20 AREA-AVERAGED FD(INCH/HR) = 0.20 AREA-AVERAGED FD(INCH/HR) = 0.20 AREA-AVERAGED FD = 0.40 EFFECTIVE STREAM AREA(ACRES) = 2.47 TOTAL STREAM AREA(ACRES) = 2.54 PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.91
	E INDEPENDENT STREAM FOR CONFLUENCE<

	(CES) = 8.91 EL TIME(MIN.) = 0.09 TC(MIN.) = 10.74 LOWPATH FROM NODE 5.00 TO NODE 40.00 = 537
	ELEVATION DATA: UPSTREAM(FEET) = 66.80 DOWNSTREAM(FEET) = 66.60 FLOW LENGTH(FEET) = 30.00 MANNING'S N = 0.013 DEPTH OF FLOW IN 21.0 INCH PIPE IS 13.0 INCHES PIPE-FLOW VELOCITY(FEET/SEC.) = 5.68 ESTIMATED PIPE DIAMFTER(INCH) = 21.00 NUMBER OF DIPES = 1
	>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<< >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
á	**************************************
	# 1 ^^^

	COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: PEAK FLOW RATE(CFS) = 8.91 Tc(MIN.) = 10.652 EFFECTIVE AREA(ACRES) = 2.47 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 TOTAL AREA(ACRES) = 2.54 LONGEST FLOWPATH FROM NODE 5.00 TO NODE 30.00 = 507.00 FEET.
	8.91 10.65 4.030 0.20(8.91 10.65 3.938 0.20(8.86 11.11 3.938 0.20(8.68 11.66 3.827 0.20(AL AREA(ACRES) = 2.54
	.87 10.32 4.096 0.20(0.08) 0.40 2.4
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9.24 (MIN.) (ACRES) (INCH/HR) (DECIMAL) CN 0.89 0.40 Αp SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.23 AREA SCS SOIL 0.89 GROUP 0.23 Д SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ RESIDENTIAL

********************** 42.00 IS CODE = 62 41.00 TO NODE FLOW PROCESS FROM NODE

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<

>>>> (STREET TABLE SECTION # 1 USED) <<<<

68.00 UPSTREAM ELEVATION(FEET) = 68.53 DOWNSTREAM ELEVATION(FEET) = 115.00 CURB HEIGHT(INCHES) = 4.8 STREET HALFWIDTH (FEET) = 15.00 STREET LENGTH (FEET) =

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 INSIDE STREET CROSSFALL (DECIMAL) = 0.020

0.0150 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

Š 1.23 (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp 10.61 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = Tc(MIN.) = 0.20 AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.40
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.38 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.038 0.19 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA 1.37 STREET FLOW DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH (FEET) = STREET FLOW TRAVEL TIME (MIN.) = GROUP Ω "8-10 DWELLINGS/ACRE" RESIDENTIAL

DEPTH(FEET) = 0.29 HALFSTREET FLOOD WIDTH(FEET) = 9.82 FLOW VELOCITY(FEET/SEC.) = 1.46 DEPTH*VELOCITY(FT*FT/SEC.) = 0.42 42.00 = 307.00 FEET. 1.00 TO NODE END OF SUBAREA STREET FLOW HYDRAULICS: LONGEST FLOWPATH FROM NODE

AREA-AVERAGED Fm(INCH/HR) = 0.08

EFPECTIVE AREA (ACRES) = 0.42 AREA-AVERAGED FMILNGH/HR)
AREA-AVERAGED FP (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40

0.19

SUBAREA AREA (ACRES) =

0.68

SUBAREA RUNOFF(CFS) =

1.50

PEAK FLOW RATE(CFS) =

0.42

TOTAL AREA (ACRES) =

FLOW PROCESS FROM NODE 42.00 TO NODE 42.00 IS CODE = 81

SCS CN 75 Ap (DECIMAL) AREA FP (ACRES) (INCH/HR) >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.038 SUBAREA LOSS RATE DATA(AMC II): DEVELOPMENT TYPE/ SCS SOIL AREA GROUP MAINLINE TC(MIN) = 10.61 LAND USE

0.20

0.20

0.07

ð

APARTMENTS

EFPECTIVE AREA (ACRES) = 0.49 AREA-AVERAGED FM (INCH/HR) = 0.07 AREA-AVERAGED AP = 0.37 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE (CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.20 0.07 0.49 SUBAREA AREA (ACRES) = TOTAL AREA (ACRES) =

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************************************ 40.00 IS CODE = 31 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<< 68.00 DOWNSTREAM(FEET) = ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<< FLOW LENGTH (FEET) = 65.00 MANNING'S N = 0.013 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 4.2 INCHES 42.00 TO NODE PIPE-FLOW VELOCITY (FEET/SEC.) = 5.67 DEPTH OF FLOW IN 18.0 INCH PIPE IS ELEVATION DATA: UPSTREAM(FEET) = FLOW PROCESS FROM NODE

******************* 40.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE << < < CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: 1.75 40.00 TO NODE EFFECTIVE STREAM AREA (ACRES) = 0.49 TIME OF CONCENTRATION(MIN.) = 10.80 4.00 PEAK FLOW RATE (CFS) AT CONFLUENCE = 0.49 AREA-AVERAGED FM(INCH/HR) = 0.07 AREA-AVERAGED Fp(INCH/HR) = 0.20 RAINFALL INTENSITY(INCH/HR) = TOTAL NUMBER OF STREAMS = 3 TOTAL STREAM AREA (ACRES) = FLOW PROCESS FROM NODE 0.37 AREA-AVERAGED Ap =

40.00 = 372.00 FEET.

Tc(MIN.) = 10.80

0.19.

1,75

1.00 TO NODE

LONGEST FLOWPATH FROM NODE

PIPE TRAVEL TIME (MIN.) =

PIPE-FLOW(CFS) =

(MIN.) 9.18 68.18 (ACRES) (INCH/HR) (DECIMAL) CN 5.00 TO NODE 45.00 IS CODE = 21 70.00 DOWNSTREAM(FEET) = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.178
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.403
SUBAREA TC AND LOSS RATE DATA(AMC II): Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 цъ INITIAL SUBAREA FLOW-LENGTH(FEET) = 253.00 0.40 AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = 1.56 GROUP Д FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/ LAND USE

46.00 IS CODE = 62 45.00 TO NODE FLOW PROCESS FROM NODE

1.56

PEAK FLOW RATE(CFS) =

0.40

TOTAL AREA (ACRES) =

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STREET LENGTH(FEET) = 57.00 CURB HEIGHT(INCHES) = 4.8
STREET HALFWIDTH(FEET) = 15.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<>>>>> (STREET TABLE SECTION # 1 USED) <<<<
                                                                                                                                                                                                                SUBAREA AVERAGE PERVIOUS LOSS RATE, FD(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, AD = 0.20
SUBAREA AREA(ACRES) = 0.07
SUBAREA RUNOFF(CFS) = 0.57
AREA-AVERAGED Fm(INCH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           UPSTREAM ELEVATION(FEET) =
                                                                                  FLOW PROCESS FROM NODE
                                                                                                                                                                  TOTAL AREA(ACRES) =
                                                                                                                                                                                          AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.38
                                                                                                                                                                                                                                                                                                                                  APARIMENTS
                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA LOSS RATE DATA (AMC
                                                                                                                                                                                                                                                                                                                                                                                                                                             * 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.274
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  MAINLINE TC (MIN) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          FLOW VELOCITY(FEET/SEC.) = 2.21 DEPTH*VELOCITY(FT*FT/SEC.) = 0.59
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  DEPTH(FEET) = 0.27 HALFSTREET FLOOD WIDTH(FEET) = 8.91
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     TOTAL AREA(ACRES) = 0.50
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA AVERAGE PERVIOUS AREA FRACTION, AP = SUBAREA AREA(ACRES) = 0.10 SUBAREA RU
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                RESIDENTIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STREET FLOW TRAVEL TIME (MIN.) = 0.44
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREET PARKWAY CROSSFALL (DECIMAL) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
                             >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                        DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.274
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREET FLOW DEPTH(FEET) = 0.26
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             LAND USE
                                                                                                                                                                                                                                                                                                                                                             LAND USE
                                                                                                                                                                  0.57
                                                                                                                                                                                                                                                                                                                                                                                  SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SCS SOIL
                                                                                                                                                                                                                                                                                                                                                             GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        0.50
                                                                                  46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  U
                                                                                                                                                                                                                                                                                                                                  U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             68.18 DOWNSTREAM ELEVATION(FEET) = 67.50
                                                                                                                                                                                                                                                                                                                                                                                                                  II):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                             (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                        AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA
                                                                                                                                                                  PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                     AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     8.63
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                  SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.10
                                                                                                                                                                                                                                                                                                                                0.07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2.17
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  TC(MIN.) = 9.62
                                                                                  40.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                46.00 IS CODE = 81
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ď
                                                                                                                                                                                                                                                                                                                                                                                     Fρ
                                                                                                                                                                                                                                                                                                                                  0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                46.00 = 310.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   5.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.40
                                                                                                                                                                                                                                                                                                                                  0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Αp
                                                                                                                                                                                                                                                                                                                                                                                     Αþ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.38
                                                                                                                                                                                                                                                  0.27
                                                                                                                                                                  2.15
                                                                                                                                                                                                                                                                                                                                SCS
CN
75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     1.89
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Q
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     75
```

```
FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          PIPE-FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          PIPE-FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.6 INCHES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                FLOW LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                          TIME OF CONCENTRATION(MIN.) = 9.72
RAINFALL INTENSITY(INCH/HR) = 4.24
                                                                                                                                                                                                                                                                                                                                                                                            CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
                                                                                                                                                                                                                                                                                                                                                                                                                                              >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES < < < <
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PIPE TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ESTIMATED PIPE DIAMETER (INCH) = 18.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
                                                                                                                                                                                                                                                  PEAK FLOW RATE (CFS) AT CONFLUENCE =
                                                                                                                                                                                                                                                                     TOTAL STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                   EFFECTIVE STREAM AREA(ACRES) =
                                                                                                                                                                                                                                                                                                      AREA-AVERAGED Ap =
                                                                                                                                                                                                                                                                                                                      AREA-AVERAGED Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                     AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                             TOTAL NUMBER OF STREAMS =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<
                                                                                                                                                                                                                ** CONFLUENCE DATA **
                                                                                                                                                                             NUMBER
                                                                                                                                                                             (CFS) (MIN.) (INCH/HR) (INCH/HR)
                                                                                      8.91
                                                                      8.68
                                                                                                                          8.90
                                                                                                                                                            8.68
                                                                                                                                             8.87
                                                   10.80
                                                                    10.60
10.74
11.20
11.75
                                                                                                                                           10.41
                                                                                                                                                            9.58
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2.15
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                40.00 MANNING'S N = 0.013
                                                                                                                                                                                                Intensity
                                                                   4.079 0.20( 0.08) 0.40

4.040 0.20( 0.08) 0.40

4.012 0.20( 0.08) 0.40

3.920 0.20( 0.08) 0.40

3.809 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  40.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        0.11
                                    4.000 0.20(0.07)
4.241 0.20(0.08)
                                                                                                                                                            4.285 0.20( 0.08) 0.40
                                                                                                                                                                                                                                                                     0.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       5.00 TO NODE
                                                                                                                                                                                                                                                                                     0.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            6.14
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              67.50 DOWNSTREAM(FEET) =
                                                                                                                                                                                                Fp (Fm)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           NUMBER OF PIPES =
                                                                                                                                                                                                                                                    2.15
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  40.00 IS CODE = 1
                                                       0.37
                                     0.38
                                                                                                                                                                                             Αp
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       9.72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       40.00 = 350.00 FEET.
                                                                                                                                                                             (ACRES)
                                                                                                                                                                                                Ãе
                                                                    2 2 2 2 3
                                                                                                                                                                                               HEADWATER
                                                                                                                                                                                 NODE
                                     21.00
5.00
1.00
1.00
5.00
                                                                                                                          21.00
                                                                                                                                           25.00
                                                                                                                                                            25.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               66.60
```

** PEAK FLOW RATE TABLE **

CONFLUENCE FORMULA USED FOR

3 STREAMS

TOTAL AREA(ACRES) = 3.60 LONGEST FLOWPATH FROM NODE 5.00 TO NODE 40.00 = 53	AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39	EFFECTIVE AREA(ACRES) = 3.53 AREA-AVERAGED Fm(INCH/HR)	PEAK FLOW RATE (CFS) = 12.68 TC (MIN.) = 10.74	COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:	8 12.28 11.75 3.809 0.20(0.08) 0.39 3.6	7 12.56 11.20 3.920 0.20(0.08) 0.39 3.6	6 12.68 10.80 4.000 0.20(0.08) 0.39 3.5	5 12.68 10.74 4.012 0.20(0.08) 0.39 3.5	4 12.68 10.60 4.040 0.20(0.08) 0.39 3.5	3 12.65 10.41 4.079 0.20(0.08) 0.39 3.5	2 12.54 9.72 4.241 0.20(0.08) 0.39 3.3	1 12.49 9.58 4.285 0.20(0.08) 0.39 3.2	NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) N	STREAM Q To Intensity Fp(Fm) Ap Ae HEA:	"" BEON FEON POLICE FORES ""
0.00 =	0.3	n(INCH/H	.74		3.6	3.6	3.5	3.5	3.5	3.5	ω ω	3.2	CRES)		
537.00 FEET.	9	R) = 0.08			1.00	5.00	1.00	21.00	21.00	25.00	5.00	25.00	NODE	HEADWATER	

********************* FLOW PROCESS FROM NODE 40.00 TO NODE 50.00 IS CODE =

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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

65.30 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<

ELEVATION DATA: UPSTREAM(FEET) = 66.60 DOWNSTREAM(FEET) = FLOW LENGTH(FEET) = 330.00 MANNING'S N = 0.013
DEPTH OF PLOW IN 24.0 INCH PIPE IS 18.1 INCHES
PIPE-FLOW WELCOTTY(FEET/SEC.) = 5.00
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1

50.00 = 867.00 FEET. Tc(MIN.) = 11.845.00 TO NODE PIPE TRAVEL TIME (MIN.) = 1.10 LONGEST FLOWPATH FROM NODE 12.68 PIPE-FLOW(CFS) ==

25.00 5.00 25.00 21.00 1.00 5.00 TOTAL AREA(ACRES) = 3.60 TC(MIN.) = 11.84

REPECTUVE AREA(ACRES) = 3.53 AREA-AVERAGED FW(INCH/HR) = 0.08

AREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39

PEAK FLOW RAIE (CFS) = 12.68 HEADWATER NODE Ae (ACRES) 0.20(0.08) 0.39 0.20(0.08) 0.39 0.20(0.08) 0.39 0.20(0.08) 0.39 0.20(0.08) 0.39 0.20(0.08) 0.39 Αp (INCH/HR) Fp (Fm) CF9) (MIN.) (INCH/HR) (INC ** PEAK FLOW RATE TABLE ** END OF STUDY SUMMARY: STREAM NUMBER

END OF RATIONAL METHOD ANALYSIS

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APPENDIX C: 2-YEAR ANALYSIS FOR EXISTING AND PROPOSED

Date: 06/13/11

File name: EX-A-2.RES

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Date: 06/13/11

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Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-A-2.DAT TIME/DATE OF STUDY: 10:48 06/13/2011

--*TIME-OF-CONCENTRATION MODEL*--

SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00 USER SPECIFIED STORM EVENT(YEAR) =

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD *DATA BANK RAINFALL USED*

0.67 2.00 0.0312 0.167 0.0150 2.00 0.0312 0.167 0.0150 HIKE FACTOR *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* (n CURB GUTTER-GEOMETRIES: (FT) (FT) / OUT-/PARK- HEIGHT WIDTH LIP (FT) STREET-CROSSFALL: 0.020/0.020/0.020 SIDE / SIDE/ WAY WIDTH CROSSFALL IN-HALF - CROWN TO (FI) 10.0

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb) as

2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A PLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

TC (MIN.) 69.70 DOWNSTREAM(FEET) = 69.00 GROUP (ACRES) (INCH/HR) (DECIMAL) CN
D 0.36 0.20 0.10 57 2.00 IS CODE = 21 0.58 0.10 Αp >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< COMMERCIAL D 0.36 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 PEAK FLOW RATE(CFS) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.796 INITIAL SUBAREA FLOW-LENGTH (FEET) = 185.00 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 1.00 TO NODE AREA SUBAREA TC AND LOSS RATE DATA(AMC I): ELEVATION DATA: UPSTREAM(FEET) = SCS SOIL 0.58 0.36 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/

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************************ 05 AREA-AVERAGED Fm(INCH/HR) = 0.020.20 AREA-AVERAGED Ap = 0.100.97 CN 57 0.68 2.00 IS CODE = 81 0.40 3.00 IS CODE = 91 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.65 AVERAGE FLOW DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00 (ACRES) (INCH/HR) (DECIMAL) GROUP (ACRES) (INCH/HR) (DECIMAL) 7.89 0.10 0.10 "V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.250 1.32 "V" GUTTER PLOW TRAVEL TIME (MIN.) = 0.41 TC (MIN.) = 7. STIBAREA AREA (ACRES) = 0.44 SUBAREA RUNOFF (CFS) = Αp SUBAREA RUNOFF(CFS) = Αp >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA< PEAK FLOW RATE(CFS) = PEAK FLOW RATE(CFS) = COMMERCIAL D 0.44 0.20 (SUBAREA AVERAGE PERVIOUS LOSS RATE, Pp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 COMMERCIAL D 0.25 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 PAVEMENT LIP(FEET) = 0.375 MANNING'S N = .0150 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = MAINLINE TC(MIN) = 7.48 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.796 MAXIMUM DEPTH(FEET) = 0.70 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.742 PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000 CHANNEL LENGTH THRU SUBAREA(FEET) = 65.00 68.84 2.00 TO NODE 69.00 2.00 TO NODE AREA AREA DOWNSTREAM NODE ELEVATION (FEET) = SCS SOIL SCS SOIL 1.05 SUBAREA LOSS RATE DATA(AMC I): SUBAREA LOSS RATE DATA(AMC I): UPSTREAM NODE ELEVATION(FEET) = GROUP 0.25 0.61 AREA-AVERAGED Fp(INCH/HR) = 1.05 EFFECTIVE AREA(ACRES) = FLOW PROCESS FROM NODE FLOW PROCESS FROM NODE SUBAREA AREA (ACRES) = TOTAL AREA (ACRES) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ DEVELOPMENT TYPE/

DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP] NOTE: TRAVEL TIME ESTIMATES BASED ON NORMAL

3.00 = 250.00 FEET. 2.65 DEPTH*VELOCITY(FT*FT/SEC) = DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) = 3.00 1.00 TO NODE END OF SUBAREA "V" GUTTER HYDRAULICS: LONGEST FLOWPATH FROM NODE FLOW VELOCITY (FEET/SEC.) =

FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 51 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT) <<<< >>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<

ELEVATION DATA: UPSTREAM(FEET) = 68.84 DOWNSTREAM(FEET) = 68.56 CHANNEL SLOPE = 0.0040 6.000 MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 70.00 0.00 "Z" FACTOR = CHANNEL LENGTH THRU SUBAREA(FEET) = CHANNEL BASE (FEET) =

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SUBAREA AKEA (ACRES) = 1.56 AREA-AVERAGED F. INCH/HR) = 0.20 AREA-AVERAGED AP = 0.10

AREA-AVERAGED F. INCH/HR) = 0.20 PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              MAINLINE TC(MIN) = 8.48
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   FLOW VELOCITY (FEET/SEC) = 1.99 FLOW DEPTH (FEET) = 0.37
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CHANNEL FLOW THRU SUBAREA(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     CHANNEL LENGTH THRU SUBAREA (FEET) = 110.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     UPSTREAM NODE ELEVATION (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SUBAREA AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/Hr) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SUBAREA LOSS RATE DATA(AMC I):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                      TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 4.58
AVERAGE FLOW DEPTH (FEET) = 0.62 FLOOD WIDTH (FEET) = 3.00
"V" GUTTER FLOW TRAVEL TIME(MIN.) = 0.40 TC(MIN.) = 8.88
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA LOSS RATE DATA (AMC I):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PAVEMENT LIP(FEET) = 0.375
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         "V" GUTTER WIDTH (FEET) = 3.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DOWNSTREAM NODE ELEVATION (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                MAXIMUM DEPTH(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000
>>>> (STREET TABLE SECTION # 1 USED) <<<<<
                         >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                                                              FLOW PROCESS FROM NODE
                                                                                                                                                     LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                 FLOW VELOCITY (FEET/SEC.) = 4.58 DEPTH*VELOCITY (FT*FT/SEC) =
                                                                                                                                                                                                           DEPTH(FEET) = 0.62 FLOOD WIDTH(FEET) =
                                                                                                                                                                                                                                      END OF SUBAREA "V" GUTTER HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                     TOTAL AREA(ACRES) = 1.92
                                                                                                                                                                                                                                                                                                                                                                                               AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                      EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.672
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.628
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             LAND USE
                                                                                                                                                                                                                                                                                    NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              0.59
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.51
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  0.70
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      SCS SOIL AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  GROUP (ACRES) (INCH/HR) (DECIMAL)
D 0.51 0.20 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                               0.36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      4.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                4.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                   1.92
                                                                              5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Tc(MIN.) = 8.4
1.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                MANNING'S N = .0150
                                                                                                                                                        1.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (ACRES) (INCH/HR) (DECIMAL)
0.36 0.20 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         GUTTER HIKE (FEET) = 0.250
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            AREA-AVERAGED Fm(INCH/HR) = 0.02
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SUBAREA RUNOFF (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          68.56
                                                                                                                                                                                                                                                                                                                                                                                                                        AREA-AVERAGED Fm(INCH/HR) =
                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA RUNOFF (CFS) =
                                                                                                                                                                                                                                                                                                                                                                     PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              67.75
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              8.48
                                                                                                                                                                                                             3.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      4.00 IS CODE = 81
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                                                                                 6.00 IS CODE = 62
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  4.00 = 320.00 FEET.
                                                                                                                                                             5.00 =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       2.58
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     Αp
                                                                                                                                                             430.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        0.76
                                                                                                                                                                                                                                                                                                                                                                                                                                                    0.52
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            2.32
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       CN
57
                                                                                                                                                                                                                                                                                                                                                                        2.78
                                                                                                                                                                                                                                                                                                                                                                                                                           0.02
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UPSTREAM ELEVATION(FEET) = 67.75 DOWNSTREAM ELEVATION(FEET) = STREET LENGTH(FEET) = 195.00 CURB HEIGHT(INCHES) = 8.0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               INSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 10.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           STREET HALFWIDTH (FEET) = 30.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STREET FLOW TRAVEL TIME (MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 1.93 PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   SUBAREA AREA(ACRES) = 0.01
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SUBAREA LOSS RATE DATA(AMC I):
                                                                                                                                                                                                 TOTAL AREA(ACRES) = 2.67
                                                                                                                                                                                                                            AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
                                                                                                                                                                                                                                                                                  SUBAREA AREA(ACRES) = 0.74
                                                                                                                                                                                                                                                                                                      SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10
                                                                                                                                                                                                                                                                                                                                  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                             COMMERCIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA LOSS RATE DATA(AMC I):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      MAINLINE TC(MIN) = 11.72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       FLOW VELOCITY(FEET/SEC.) = 1.15 DEPTH*VELOCITY(FT*FT/SEC.) = 0.53
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   DEPTH(FEET) = 0.46 HALFSTREET FLOOD WIDTH(FEET) = 14.90
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      TOTAL AREA(ACRES) =
                                                 PEAK FLOW RATE(CFS) =
                                                                          AREA-AVERAGED Fp(INCH/HR) = 0.20
                                                                                                                              TOTAL AREA (ACRES)
                                                                                                                                                    END OF STUDY SUMMARY:
                                                                                                                                                                                                                                                       EFFECTIVE AREA(ACRES) =
                                                                                                     EFFECTIVE AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                            DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            STREET FLOW DEPTH (FEET) = 0.46
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.388
                                                                                                                                                                                                                                                                                                                                                                                                                                                                2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.388
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      LAND USE
                                                                                                                                                                                                                                                                                                                                                                                   LAND USE
                                                                                                                              II
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                                                                                                                                                                                                                                                                                                                                                                                                              SCS SOIL AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         GROUP (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     1.93
                                                                                                                                                                                                                                                                                                                                                                                   GROUP (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                       2.67 AREA-AVERAGED Fm(INCH/HR) = 0.02
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            6.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               U
                                                 3.29
                                                                                                                         2.67
                                                                                                     2.67
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         2.84 TC(MIN.) = 11.72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   14.97
                                                                          AREA-AVERAGED Ap = 0.10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          AREA-AVERAGED Fm(INCH/HR) = 0.02
                                                                                                                              TC(MIN.) =
                                                                                                                                                                                                      PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             0.01
                                                                                                                                                                                                                                                                                  SUBAREA RUNOFF(CFS) =
                                                                                                     AREA-AVERAGED Fm(INCH/HR)= 0.02
                                                                                                                                                                                                                                                                                                                                                             0.74
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             1.15
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                                                                                                                                                                                                                                                                                                                                                             0.20
                                                                                                                                                                                  6.00 = 625.00 FEET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Αþ
                                                                                                                                                                                                                                                                                                                                                             0.10
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                                                                                                                                                                                                                                                                                     0.91
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               SCS
CN
57
                                                                                                                                                                                                        3.29
                                                                                                                                                                                                                                                                                                                                                             SCS
CN
57
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  67.44
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File name: EX-A-2.RES

END OF RATIONAL METHOD ANALYSIS

Date: 06/13/11

Date: 06/13/11 File

File name: EX-B-2.RES

Page 1

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 Oceah HYDROLOGY CRITERION)
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Analysis prepared by:

RBF Consulting 14725 Alton Parkway Irvine, CA 92618 FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\EX-B-2.DAT
TIME\DATE OF STUDY: 10:55 06/13/2011

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
*DATA BANK RAINFALL USED**

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

FACTOR 2.00 0.0312 0.167 0.0150 (n) *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* HIKE CURB GUTTER-GEOMETRIES: (FT) (FT) WIDTH LIP (FT) HEIGHT 11 (FT) 0.67 STREET-CROSSFALL: / OUT-/PARK-0.018/0.018/0.020 SIDE / SIDE/ WAY -NI HALF- CROWN TO WIDTH CROSSFALL H H H H H H 20.0 (FT) 13 13 13 13 1 30.0 (FT) NO.

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEFT as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth) *(Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.00 TO NODE 21.00 IS CODE = 21
>>>> FAITONAL METHOD INITIAL SUBARRA ANALYSIS<>>>
>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBARRA<

INITIAL SUBAREA FLOW-LENGTH (FBET) = 225.00

68.41

69.20 DOWNSTREAM(FEET) =

ELEVATION DATA: UPSTREAM(FEET) =

(MIN.) CN 57 (ACRES) (INCH/HR) (DECIMAL) 0.10 Ap SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 8.216 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.702 SUBAREA TC AND LOSS RATE DATA(AMC I): DEVELOPMENT TYPE/ SCS SOIL AREA FP 0.59 GROUP 0.89 Д SUBAREA RUNOFF(CFS) = LAND USE

PEAK FLOW RATE(CFS) =

0.59

rotal area (acres) =

Date: 06/13/11 File name: EX-B-2.RES

Page 2

AREA-AVERAGED Fm(INCH/HR) = 0.02 1.53 0.02 S 0.64 21.00 IS CODE = 81 (ACRES) (INCH/HR) (DECIMAL) AREA-AVERAGED Fm(INCH/HR) = AREA-AVERAGED Ap = 0.10 0.10 0.10 Αp SUBAREA RUNOFF (CFS) = PEAK FLOW RATE(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 EFFECTIVE AREA(ACRES) = 1.01 AREA-AVERAGED Fm(AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10 MAINLINE TC(MIN) = 8.22 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.702 TC(MIN.) == 21.00 TO NODE 0.42 AREA TOTAL AREA(ACRES) = 1.01
EFFECTIVE AREA (ACRES) = 1.01
AREA-AVERAGED FP (INCH/HK) = 0.20
PEAK FLOW RATE(CFS) = 1.53 SUBAREA LOSS RATE DATA(AMC I): DEVELOPMENT TYPE/ SCS SOIL END OF RATIONAL METHOD ANALYSIS GROUP 0.42 Δ 1.01 FLOW PROCESS FROM NODE SUBAREA AREA (ACRES) = END OF STUDY SUMMARY: TOTAL AREA (ACRES) = LAND USE

			Date: 06/13/11
			File name: EX-B-2.RES
			Page 3

NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)

AND LOW LOSS FRACTION ESTIMATIONS

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Analysis prepared by:

RBF Consulting 14725 Alton Parkway Irvine, CA 92618

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm) AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.05 (inches)

SOIL-COVER AREA PERCENT OF SCS CURVE LOSS RATE
TYPE (Acres) PERVIOUS AREA NUMBER Fp(in./hr.) YIELD
1 3.68 90.00 95.(98.) 0.200 0.761

TOTAL AREA (Acres) = 3.68

AREA-AVERAGED LOSS RATE, Fm (in./hr.) = 0.180

AREA-AVERAGED LOW LOSS FRACTION, Y = 0.239

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	obidiani.

File name: HYD-EX-2.RES ***********************************	Page 1 Date: 06/13/11	4.67	5.06	5.45 0.0402		6.43 0.0488			8 190 0 08 L		8.38 0.0678			9.16 0.0763	9.36 0.0785					10.53 0.0928		0.1.01 L2 L1 C.1.03L	11.90		12.48 0.1220			13.07 0.1344							14.63 0.1762								
######################################	HYD-EX-2.RES	********************	OGRAPH MODEL	Engineering soitware (aes)	ed by:	1111g	2618		0.90			ID BY USER)		S ARE USED	1	1 8	н	II.	11	31		D 18	******	5.0																			
	File name: 1	********	SMALL AREA UNIT HYDRO	opyright 1989-2001 Advanced er 8.0 Release Date: 01/01	Analysis prepare	ABF CONSULT.	Irvine, CA 9.		ETHOD CALIBRATION COEFFICIEN	TOTAL CATCHMENT AREA (ACRES) = 3.68	RACTION = 0.239 NCENTRATION(MIN) = 11 72	ETHOD PEAK FLOW RATE (DEFINE)	IS USED FOR SMALL AREA PEAK Q	MTY "VALLEY" RAINFALL VALUES	QUENCY (YEARS) = 2 PP POINT PAINFALL WALLY (INCHE	30-MINUTE POINT RAINFALL VALUE (INCHE	POINT		POINT RAINFALL VALUE (INCHE)	FOINT KAINFALL VALUE (INCHE	Citata	HAMENT SOIL-LOSS VOLUME ACRE-	*****	E Q 0.	1 1	0.08	0.08	80.0	80.0	80.0	0.08	60.0	60.0	60.0	0.09	60.0	60.0	60.0	60.0	60.0	60.0	,	0.0 0.0 01.0

4.67 0.0337 0.10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		6							
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Page 2

name: PROP-2.RES

(Reference: 1986 OCEMA HYDROLOGY CRITERION)
(C) Copyright 1983-2001 Advanced Engineering Software (aes) Ver. 8.0 Release Date: 01/01/2001 License ID 1264 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE

Analysis prepared by:

14725 Alton Parkway Irvine, CA 92618 RBF Consulting

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION: FILE NAME: H:\PDATA\10108016\CALCS\LAND\HYDRO\PROP-2.DAT --*TIME-OF-CONCENTRATION MODEL*--TIME/DATE OF STUDY: 10:57 06/13/2011

USER SPECIFIED STORM EVENT(YEAR) = 2.00 SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95 *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD* *DATA BANK RAINFALL USED*

1.00 0.0312 0.080 0.0150 HIKE FACTOR (n) *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL* CURB GUTTER-GEOMETRIES: (FT) (FT) WIDTH LIP (FT) 11 13 13 14 14 IN- / OUT-/PARK- HEIGHT 0.40 (FT) STREET-CROSSFALL: SIDE / SIDE/ WAY HALF- CROWN TO WIDTH CROSSFALL 5.0 (FI) 1 15.0 (FI) NO.

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED (Depth) * (Velocity) Constraint = 6.0 (FT*FT/S) *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.* 0.020/0.020/0.020 GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

9.17 ************************ (ACRES) (INCH/HR) (DECIMAL) CN (MIN.) 68.50 JG. SCS 2.00 IS CODE = 21 0.33 69.30 DOWNSTREAM(FEET) = 0.40 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Αp "8-10 DWELLINGS/ACRE" D 0.24 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 PEAK FLOW RATE(CFS) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.16
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.598
SUBAREA TC AND LOSS RATE DATA(AMC I): Fр INITIAL SUBAREA FLOW-LENGTH(FEET) = 192.00 1.00 TO NODE AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = 0.33 GROUP 0.24 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/

10.00 TO NODE

FLOW PROCESS FROM NODE

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TOTAL NUMBER OF STREAMS = 2

TIME OF CONCENTRATION(MIN.) = 11.88
RAINFALL INTENSITY(INCH/HR) = 1.38

AREA-AVERAGED Fm(INCH/HR) = 0.08

AREA-AVERAGED Fp(INCH/HR) = 0.20

AREA-AVERAGED AP

10.00 IS CODE = 1

DEPTH(FEET) = 0.23 HALFSTREET FLOOD WIDTH(FEET) = 6.80 FLOW VELOCITY(FEET/SEC.) = 1.05 DEPTH*VELOCITY(FT*FT/SEC.) = LONGEST FLOWPATH FROM NODE 1.00 TO NODE 10.00 = 356.00

END OF SUBAREA STREET FLOW HYDRAULICS:

 EFFECTIVE AREA (ACRES)
 0.47
 AREA-AVERAGED FM (INCH/HR)
 0.00

 AREA-AVERAGED FP (INCH/HR)
 0.20
 AREA-AVERAGED AP
 0.40

 TOTAL AREA (ACRES)
 0.47
 PEAK FLOW RATE (CFS)
 0.55

0.27

SUBAREA RUNOFF(CFS) =

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40

SUBAREA AREA(ACRES) = 0.23

10.00 = 356.00 FEET.

5.00 TO NODE

FLOW PROCESS FROM NODE

0.55

0.47

EFFECTIVE STREAM AREA (ACRES) = 0.47

PEAK FLOW RATE(CFS) AT CONFLUENCE =

TOTAL STREAM AREA (ACRES) =

6.00 IS CODE = 21

0.0150 67.90 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 S 57 UPSTREAM ELEVATION(FEET) = 68.50 DOWNSTREAM ELEVATION(FEET) = 10.00 IS CODE = 62 (ACRES) (INCH/HR) (DECIMAL) 0.40 STREET LENGTH(FEET) = 164.00 CURB HEIGHT(INCHES) = 4.8 Αp DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 INSIDE STREET CROSSFALL(DECIMAL) = 0.020 STREET FLOW TRAVEL TIME (MIN.) = 2.71 TC (MIN.) = 11.88 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: Fр 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.377 1.01 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.23 2.00 TO NODE 6.31 AREA AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET FLOW DEPTH(FEET) = 0.22 SCS SOIL HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC I): GROUP STREET HALFWIDTH (FEET) = 15.00 Д FLOW PROCESS FROM NODE "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< STREET LENGTH (FEET) = 112.00 CURB HEIGHT (INCHES) = 4.8 FLOW PROCESS FROM NODE SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA TC AND LOSS RATE DATA(AMC SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20ELEVATION DATA: UPSTREAM(FEET) = INITIAL SUBAREA FLOW-LENGTH (FEET) = >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS AREA-AVERAGED FP (INCH/HR) = 0.58 AREA-AVERAGED FP (INCH/HR) = 0.40
TOTAL AREA (ACRES) = 0.58 PEAK FLOW PARTY (TOTAL STREET FLOW TRAVEL TIME (MIN.) = Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = STREET HALFWIDTH (FEET) = 15.00 UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) = >>>> (STREET TABLE SECTION # 1 USED) <<<<< >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA TOTAL AREA(ACRES) = SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" RESIDENTIAL SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA LOSS RATE DATA(AMC I): Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 INSIDE STREET CROSSFALL(DECIMAL) = 0.020 DEPTH(FEET) = 0.25 HALFSTREET FLOOD WIDTH(FEET) = RESIDENTIAL LONGEST FLOWPATH FROM NODE FLOW VELOCITY(FEET/SEC.) = 0.97 DEPTH*VELOCITY(FT*FT/SEC.) = 0.25 END OF SUBAREA STREET FLOW HYDRAULICS: "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/ DEVELOPMENT TYPE/ STREETFLOW MODEL RESULTS USING ESTIMATED FLOW-STREET FLOW DEPTH(FEET) = 0.25 AVERAGE FLOW VELOCITY (FEET/SEC.) = HALFSTREET FLOOD WIDTH (FEET) = PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.597 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.428 LAND USE LAND USE 0.39 SCS SOIL 0.19 SCS SOIL AREA GROUP GROUP 6.00 TO NODE 0.53 U PEAK FLOW RATE(CFS) = (ACRES) (INCH/HR) (DECIMAL) CN 5.00 TO NODE (ACRES) (INCH/HR) (DECIMAL) 1.99 Tc(MIN.) = 11.16AREA SUBAREA RUNOFF(CFS) = 7.93 0.39 0.19 70.00 DOWNSTREAM(FEET) = 253.00 0.94 9.178 Fρ 10.00 IS CODE = 62 0.23 Ψ 0.20 0.20 10.00 = 365.00 FEET 0.40 0.40 Αþ Αp 0.65 0.53 Q 67.90 0.0150 68.18 (MIN.) Tc 9.18

Date: 06/13/11 TIME OF CONCENTRATION(MIN.) = 11.16
RAINFALL INTENSITY(INCH/HR) = 1.43 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES FLOW PROCESS FROM NODE CONFLUENCE FORMULA USED FOR 2 STREAMS. RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fp(INCH/HR) = 0.20AREA-AVERAGED Fm(INCH/HR) = 0.08 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE TOTAL NUMBER OF STREAMS = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< FLOW PROCESS FROM NODE 10.00 TO NODE PEAK FLOW RATE(CFS) = 1.24 Tc(MIN.) = 11.16 EFFECTIVE AREA(ACRES) = 1.02 AREA-AVERAGED Fm(INCH/HR) = 0.08 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: ** CONFLUENCE DATA ** PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA(ACRES) = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE FLOW PROCESS FROM NODE LONGEST FLOWPATH FROM NODE PIPE-FLOW VELOCITY (FEET/SEC.) = DEPTH OF FLOW IN 18.0 INCH PIPE IS 4.3 INCHES FLOW LENGTH (FEET) = ELEVATION DATA: UPSTREAM(FEET) = >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<< LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fm(INCH/HR) = 0.08 RAINFALL INTENSITY(INCH/HR) = TIME OF CONCENTRATION(MIN.) = 11.30 RAINFALL INTENSITY(INCH/HR) = 1.42 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE TOTAL NUMBER OF STREAMS = 3 PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 ** PEAK FLOW RATE TABLE ** NUMBER STREAM NUMBER STREAM (CFS) (MIN.) (INCH/HR) (INCH/HR) (CFS) (MIN.) (INCH/HR) (INCH/HR) 0.55 11.88 1.377 0.20(0.08 0.55 11.88 1.377 0.20(0.08) 0.40 0.5 0.70 11.16 1.428 0.20(0.08) 0.40 0.6 1.24 11.16 1.428 0.20(0.08) 0.40 1.0 1.23 11.88 1.377 0.20(0.08) 0.40 1.0 Ю Tc C 1.24 32.00 Intensity Intensity 1.05 10.00 TO NODE 0.14 20.00 TO NODE 0.58 File name: PROP-2.RES MANNING'S N = 0.0135.00 TO NODE 5.00 TO NODE 0.58 3.82 Fp(Fm) Fp (Fm) Tc(MIN.) = 11.30Tc(MIN.) = 67.90 DOWNSTREAM(FEET) = 0.70 10.00 IS CODE = 20.00 IS CODE = 31 20.00 IS CODE = Αp Αp 10.00 = 365.00 FEET 20.00 = 397.00 FEET (ACRES) (ACRES) Аe Ae HEADWATER HEADWATER NODE NODE 5.00 1.00 1.00 5.00 67.60 Page 4

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AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 1.02
TOTAL STREAM AREA(ACRES) = 1.05
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.24

8.71 (ACRES) (INCH/HR) (DECIMAL) CN (MIN.) ηC SCS 0.31 0.40 Ap "8-10 DWELLINGS/ACRE" D 0.22 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 PEAK FLOW RATE(CFS) = TC = K* [(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 8.709
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.646
SUBAREA TC AND LOSS RATE DATA(AMC I): Fр AREA SCS SOIL 0.31 GROUP 0.22 SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ LAND USE

FLOW PROCESS FROM NODE 22.00 TO NODE 20.00 IS CODE = 62

>>>> (STREET TABLE SECTION # 1 USED) <<<<<
USTREET TABLE SECTION # 1 USED) <<<<<
USTREET LEVATION (FEET) = 68.36 DOWNSTREAM ELEVATION (FEET) = 67.90 STREET LENGTH (FRET) = 126.00 CURB HEIGHT (INCHES) = 4.8 STREET HALFWIDTH (FEET) = 15.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECTIVAL) = 0.020

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKMAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199

AREA-AVERAGED Fm(INCH/HR) = 0.08 S 0.23 (ACRES) (INCH/HR) (DECIMAL) 0.40 Ap TC(MIN.) = 10.84SUBAREA AVERAGE PERVIOUS LOSS RATE, FP (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.19 SUBAREA RUNOFF(CFS) = **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.20 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.21 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: * 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.452 0.99 0.19 6.10 STREET FLOW TRAVEL TIME (MIN.) = 2.13 AREA AVERAGE FLOW VELOCITY (FEET/SEC.) = STREET FLOW DEPTH(FEET) = 0.21 SCS SOIL 0.41 HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC I): GROUP Q EFFECTIVE AREA (ACRES) = "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/ LAND USE RESIDENTIAL

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AREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40

TOTAL AREA(ACRES) = 0.41 PEAK FLOW RATE(CFS) = 0.51

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.22 HALFSTREET FLOOD WIDTH(FEET) = 6.52

FLOW VELOCITY(FEET/SEC.) = 1.04 DEPTH*VELOCITY(FT*FT/SEC.) = 0.23

LONGEST PLOWPATH FROM NODE 21.00 TO NODE 20.00 = 312.00 FEET.

20.00 IS CODE = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: 0.51 20.00 TO NODE EFFECTIVE STREAM AREA (ACRES) = 0.41 1.45 TIME OF CONCENTRATION(MIN.) = 10.84 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.41 AREA-AVERAGED FW(INCH/HR) = 0.08 AREA-AVERAGED FP(INCH/HR) = 0.20 RAINFALL INTENSITY (INCH/HR) = TOTAL STREAM AREA (ACRES) = TOTAL NUMBER OF STREAMS = = 0.40 FLOW PROCESS FROM NODE AREA-AVERAGED Ap

(MIN.) 8.64 ******************* 68.04 FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 21 0.31 (ACRES) (INCH/HR) (DECIMAL) 69.00 DOWNSTREAM(FEET) = 0.40 INITIAL SUBAREA FLOW-LENGTH(FEET) = 185.00 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< Ap SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE(CFS) = 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.653 SUBAREA TC AND LOSS RATE DATA(AMC I): 0.22 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = AREA SCS SOIL ELEVATION DATA: UPSTREAM(FEET) = GROUP 0.31 0.22 Д "8-10 DWELLINGS/ACRE" SUBAREA RUNOFF(CFS) = TOTAL AREA (ACRES) = LAND USE RESIDENTIAL

DISTANCE FROM CROWN TO CROSSPALL GRADEBREAK(FEET) = 5.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199

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File name: PROP-2.RES
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SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL STREET FLOW TRAVEL TIME (MIN.) = AREA-AVERAGED Ap = 0.40 AREA-AVERAGED Fp(INCH/HR) = 0.20 RAINFALL INTENSITY (INCH/HR) = TIME OF CONCENTRATION (MIN.) = 10.40 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE: TOTAL NUMBER OF STREAMS = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES FLOW PROCESS FROM NODE 20.00 TO NODE 20.00 IS CODE = 1 LONGEST FLOWPATH FROM NODE FLOW VELOCITY(FEET/SEC.) = 0.76 DEPTH*VELOCITY(FT*FT/SEC.) = 0.17 DEPTH(FEET) = 0.23 HALFSTREET FLOOD WIDTH(FEET) = END OF SUBAREA STREET FLOW HYDRAULICS: TOTAL AREA(ACRES) = 0.33 AREA-AVERAGED fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40EFFECTIVE AREA(ACRES) = SUBAREA AREA (ACRES) = RESIDENTIAL COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: CONFLUENCE FORMULA USED FOR 3 STREAMS PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA (ACRES) = EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Fm(INCH/HR) = 0.08 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< "8-10 DWELLINGS/ACRE" ** PEAK FLOW RATE TABLE ** ** CONFLUENCE DATA ** PEAK FLOW RATE(CFS) = RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO NUMBER NUMBER STREAM STREAM HALFSTREET FLOOD WIDTH (FEET) = STREETFLOW MODEL RESULTS USING ESTIMATED STREET FLOW DEPTH(FEET) = 0.23 PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = AVERAGE FLOW VELOCITY (FEET/SEC.) = **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.487 LAND USE (CFS) (MIN.) (INCH/HR) (INCH/HR) 2.12 10.40 2.13 10.84 2.13 11.30 2.08 12.02 (CFS) (MIN.) (INCH/HR) (INCH/HR) 1.23 12.02 0.51 10.84 0.42 10.40 1.24 11.30 Tc TC Intensity Intensity 0.11 SCS SOIL 1.487 0.20(0.08) 0.40 1.452 0.20(0.08) 0.40 1.417 0.20(0.08) 0.40 1.368 0.20(0.08) 0.40 0.33 GROUP 1.487 0.20(0.08) 0.40 1.368 0.20(0.08) 0.40 1.452 0.20(0.08) 0.40 1.417 0.20(0.08) 0.40 2.13 0.33 25.00 TO NODE 1.49 (ACRES) (INCH/HR) (DECIMAL) 1.75 AREA Fp (Fm) Fp (Fm) PEAK FLOW RATE(CFS) = 6.73 AREA-AVERAGED Fm(INCH/HR) = 0.08 SUBAREA RUNOFF(CFS) = Tc(MIN.) = 0.11 0.74 Tc(MIN.) = 10.400.42 0.17 Ę Αp 0.20 Ąp 20.00 = 263.00 FEET (ACRES) (ACRES) 10.84 Āе Ae 7.01 1.7 1.7 1.8 1.0 1.0 0.4 0.3 0.40 Αp HEADWATER HEADWATER 0.14 0.38 NODE NODE 25.00 1.00 21.00 25.00 0.42 5.00 57

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Date: 06/13/11
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ***********************************
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              DEPTH OF FLOW IN 18.0 INCH PIPE IS
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FLOW PROCESS FROM NODE 20.00 TO NODE 30.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AREA-AVERAGED Fp(INCH/Hr) = 0.20 AREA-AVERAGED Ap = 0.40 TOTAL AREA(ACRES) = 1.79
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   EFFECTIVE AREA(ACRES) =
                                                                                                                                       STREET HALPWIDTH(FEET) = 15.00
                                                                                                                                                                                                                              * 2 YEAR RAINFALL INTENSITY(INCH/HR) = SUBAREA TC AND LOSS RATE DATA(AMC I ):
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         FLOW PROCESS FROM NODE 21.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               FLOW PROCESS FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   PIPE TRAVEL TIME (MIN.) = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            PIPE-FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       FLOW LENGTH (FEET) = 110.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ELEVATION DATA: UPSTREAM(FEET) =
                                                  OUTSIDE STREET CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                     UPSTREAM ELEVATION(FEET) = 68.39 DOWNSTREAM ELEVATION(FEET) =
                                                                                                                                                                                                                                                          >>>> (STREET TABLE SECTION # 1 USED) <<<<<
                                                                                                                                                                                                                                                                                                                                  FLOW PROCESS FROM NODE 31.00 TO NODE 32.00 IS CODE = 62
                                                                                                                                                                                                                                                                                                                                                                                                                TOTAL AREA(ACRES) =
                                                                                                                                                                                                                                                                                                                                                                                                                                      SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                               SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/Hr) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             RESIDENTIAL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ELEVATION DATA: UPSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            INITIAL SUBAREA FLOW-LENGTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =
                                                                        INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                      DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00
                                                                                                                                                                                                                                                                                   >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            2.13
                                                                                                                                                                                                                                                                                                                                                                                                                0.22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               30.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      GROUP
                                                                                                                                                                                                                                                                                                                                                                                                                                         0.31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    U
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   1.72
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       MANNING'S N = 0.013
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          5.00 TO NODE 20.00 = 397.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       5.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      (ACRES) (INCH/HR)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              4.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  67.90 DOWNSTREAM(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   AREA-AVERAGED Fm(INCH/HR) = 0.08
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   TC(MIN.) = 11.24
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  AREA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.22
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     69.30 DOWNSTREAM (FEET)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       5.6 INCHES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              186.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 1.640
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         31.00 IS CODE = 21
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        8.765
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Ğ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               30.00 IS CODE = 10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       30.00 = 507.00 FEET.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Αp
                                                                                                                                                                                                                                                                                                                                                                                                                0.31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      S
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  66.80
                                                                                                                                                                                                          67.80
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        68.39
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         (MIN.)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Tc
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    8.77
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     Page 8
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File name: PROP-2.RES Date: 06/13/11

Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

AREA-AVERAGED Fm(INCH/HR) = 0.08 0.53 (ACRES) (INCH/HR) (DECIMAL) 0.40 EFECTIVE AREA (ACRES) = 0.43 AREA-AVERAGED FM (INCH/HR)
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA (ACRES) = 0.43 PEAK FLOW RATE (CFS) = Αp SUBAREA RUNOFF(CFS) = AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.05
PRODUCT OF DEPTH&VUELOCITY(FT*FT/SEC.) = 0.22
STREET FLOW TRAVEL TIME(MIN.) = 2.22 TC(MIN.) = 10.98 "8-10 DWELLINGS/ACRE" D 0.21 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.441 д 5.96 SCS SOIL AREA STREET FLOW DEPTH (FEET) = 0.21 HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC I): GROUP 0.21 SUBAREA AREA(ACRES) = DEVELOPMENT TYPE/

32.00 = 326.00 FEET. DEPTH*VELOCITY(FT*FT/SEC.) = 0.24 DEPTH(FEET) = 0.22 HALFSTREET FLOOD WIDTH(FEET) = 6.45 21.00 TO NODE END OF SUBAREA STREET FLOW HYDRAULICS: FLOW VELOCITY (FEET/SEC.) = 1.10 LONGEST FLOWPATH FROM NODE

FLOW PROCESS FROM NODE 32.00 TO NODE 32.00 IS CODE = 1 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE << < <

TOTAL NUMBER OF STREAMS = 2 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE: EFFECTIVE STREAM AREA (ACRES) = 0.43 TIME OF CONCENTRATION(MIN.) = 10.98 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.43 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 RAINFALL INTENSITY (INCH/HR) = TOTAL STREAM AREA (ACRES) = AREA-AVERAGED Ap = 0.40

36.00 IS CODE = 21 25.00 TO NODE FLOW PROCESS FROM NODE

0.53

68.04 69.00 DOWNSTREAM(FEET) = >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.656 INITIAL SUBAREA FLOW-LENGTH (FEET) = 184.00 SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = ELEVATION DATA: UPSTREAM(FEET) =

(MIN.) 8.62 CN (ACRES) (INCH/HR) (DECIMAL) 0.40 Αp SUBAREA AVERAGE PERVIOUS LOSS RATE, FP(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.20 Fр 0.22 AREA SCS SOIL GROUP Д "8-10 DWELLINGS/ACRE" DEVELOPMENT TYPE/

SUBAREA TC AND LOSS RATE DATA(AMC I):

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0.31

SUBAREA RUNOFF(CFS) =

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********************* 67.80 UPSTREAM ELEVATION(FEET) = 68.04 DOWNSTREAM ELEVATION(FEET) = STREET LENGTH(FEET) = 64.00 CURB HEIGHT(INCHES) = 4.8 32.00 IS CODE = 62 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< 0.22 PEAK FLOW RATE(CFS) = 36.00 TO NODE >>>> (STREET TABLE SECTION # 1 USED) <<<< STREET HALFWIDTH (FEET) = 15.00 FLOW PROCESS FROM NODE

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 5.00 INSIDE STREET CROSSFALL (DECIMAL) = 0.020

0.0150 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020 = 0.020STREET PARKWAY CROSSFALL (DECIMAL)

AREA-AVERAGED Fm(INCH/HR) = 0.08 0.42 Š "8-10 DWELLINGS/ACRE" D 0.10 0.20 0.40 5SUBAREA AVERAGE PERVIOUS LOSS RATE, FD(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.13 AREA FP AP (ACRES) (INCH/HR) (DECIMAL) EFFECTIVE AREA(ACRES) = 0.32 AREA-AVERAGED FM(INH/HR)
AREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED AP = 0.40
TOTAL AREA(ACRES) = 0.32 PEAK FLOW RAIE(CFS) = 9.70 **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = Tc(MIN.) = AVERAGE FLOW VELOCITY(FEET/SEC.) = 0.99
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.20 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: ър 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.548 SCS SOIL AREA STREET FLOW TRAVEL TIME (MIN.) = 1.08 STREET FLOW DEPTH(FEET) = 0.20 HALFSTREET FLOOD WIDTH (FEET) = SUBAREA LOSS RATE DATA(AMC I): DEVELOPMENT TYPE/ SCS SOIL GROUP

32.00 = 248.00 FEET. DEPTH(FRET) = 0.21 HALFSTREET FLOOD WIDTH(FRET) = 6.03 FLOW VELOCITY(FRET/SEC.) = 1.00 DEPTH*VELOCITY(FT*FT/SEC.) = 0.21 25.00 TO NODE END OF SUBAREA STREET FLOW HYDRAULICS: LONGEST FLOWPATH FROM NODE *****************************

32.00 IS CODE = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES< >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE< TOTAL NUMBER OF STREAMS = 2 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: 0.42 32.00 TO NODE TIME OF CONCENTRATION (MIN.) = 9.70 RAINFALL INTENSITY (INCH/HR) = 1.55 PEAK FLOW RATE (CFS) AT CONFLUENCE = AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 EFFECTIVE STREAM AREA (ACRES) = TOTAL STREAM AREA (ACRES) = FLOW PROCESS FROM NODE AREA-AVERAGED Ap = 0.40

2	** CONFLOENCE DATA ** STREAM Q TC NUMBER (CFS) (MIN.	Date: 06/13/11
0.53	Q (CFS)	11
0.53 10.98 0.42 9.70	TC (MIN.)	1
1.441 1.548	Q To Intensity Fp(Fm) Q To Intensity (INCH/HR)	Fi
1.441 0.20(0.08) 0.40 1.548 0.20(0.08) 0.40	Fp(Fm) (INCH/HR)	File name: PROP-2.RES
0.40	Ap Ae (ACR	P-2.RI
0.4	Ae (ACRES)	S
21.00 25.00	HEADWATER NODE	

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM Q TC Intensity Fp(Fm) Ap Ae HEADWATER NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE

1 0.92 9.70 1.548 0.20(0.08) 0.40 0.7 25.00
2 0.92 10.98 1.441 0.20(0.08) 0.40 0.8 21.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PERAK FLOW RATE(CFS) = 0.92 TC(MIN.) = 9.70

EPFECTIVE AREA(ACRES) = 0.70 AREA-AVERAGED Fm(INCH/HR) = 0.08

AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40

TOTAL AREA(ACRES) = 0.75

LONGEST FLOWPATH FROM NODE 21.00 TO NODE 32.00 = 326.00 FEET.

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<<

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<

ELEVATION DATA: (DESTREAM(FEET) = 67.80 DOWNSTREAM(FEET) = 66.80

FLOW LENGTH(FEET) = 10.00 MANNING'S N = 0.013

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000

DEPTH OF FLOW IN 18.0 INCH PIPE IS 2.1 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 8.07

ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1

PIPE TRAVEL TIME (MIN.) = 0.02 TC (MIN.) = 9.72

LONGEST FLOWPATH FROM NODE 21.00 TO NODE 30.00 = 336.00 FEET.

PIPE-FLOW(CFS) =

0.92

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY

FLOW PROCESS FROM NODE 30.00 TO NODE 30.00 IS CODE = 11

AND THE PROPERTY OF THE PROPER

** MAIN STREAM CONFLUENCE DATA **

STREAM Q TC Intensity Fp(Fm) Ap Ae HEADWATER NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE

1 0.92 9.72 1.546 0.20(0.08) 0.40 0.7 25.00
2 0.92 11.00 1.439 0.20(0.08) 0.40 0.8 21.00

LONGEST FLOWPATH FROM NODE

21.00 TO NODE

30.00 = 336.00 FEET

** MEMORY BANK # 1 CONFLUENCE DATA ** LONGEST FLOWPATH FROM NODE NUMBER STREAM 2.12 10.80 2.13 11.24 2.13 11.70 2.08 12.42 (CFS) (MIN.) (INCH/HR) (INCH/HR) Tc Intensity 1.455 0.20(0.08) 0.40 1.7 1.422 0.20(0.08) 0.40 1.7 1.389 0.20(0.08) 0.40 1.8 1.343 0.20(0.08) 0.40 1.8 5.00 TO NODE Fp (Fm) Ap Ae 30.00 = (ACRES) HEADWATER 507.00 FEET NODE 21.00 5.00 1.00 25.00

** PEAK FLOW RATE TABLE **

STREAM Q TC Intensity Fp(Fm) Ap Ae HEADWATER NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE 1 2.95 9.72 1.546 0.20(0.08) 0.40 2.2 25.00

Date: 06/13/11 ************************ AREA-AVERAGED FD(INCH/HR) = 0.08 AREA-AVERAGED FD(INCH/HR) = 0.20 AREA-AVERAGED AD = 0.40 EFFECTIVE comment SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 9.2

* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.591 FLOW PROCESS FROM NODE >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< FLOW PROCESS FROM NODE 40.00 TO NODE PIPE-FLOW VELOCITY (FEET/SEC.) = 4.36 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000 DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.5 INCHES ELEVATION DATA: UPSTREAM(FEET) = >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< FLOW PROCESS FROM NODE 30.00 TO NODE 40.00 IS CODE = 31 >>>>CLEAR MEMORY BANK # 1 <<<<< FLOW PROCESS FROM NODE 30.00 TO NODE 30.00 IS CODE = 12 LONGEST FLOWPATH FROM NODE TOTAL AREA(ACRES) = COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS: 2 3.03 10.80 3 3.04 11.00 4 3.04 11.24 5 3.01 11.70 6 2.94 12.42 TOTAL AREA(ACRES) = ELEVATION DATA: UPSTREAM(FEET) >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS PEAK FLOW RATE (CFS) AT CONFLUENCE = EFFECTIVE STREAM AREA(ACRES) = RAINFALL INTENSITY(INCH/HR) = TIME OF CONCENTRATION (MIN.) = 11.12 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE TOTAL NUMBER OF STREAMS = LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = FLOW LENGTH (FEET) = TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 INITIAL SUBAREA FLOW-LENGTH (FEET) = 192.00 TOTAL STREAM AREA(ACRES) = 3.04 30.00 1.439 0.20(0.08) 0.40 1.422 0.20(0.08) 0.40 1.389 0.20(0.08) 0.40 1.343 0.20(0.08) 0.40 2.54 1.00 TO NODE 41.00 IS CODE = 21 0.11 2.54 2.54 MANNING'S N = File name: PROP-2.RES 5.00 TO NODE 5.00 TO NODE 2.44 0.20(0.08) 0.40 66.80 DOWNSTREAM(FEET) = Tc(MIN.) = 11.1269.30 3.04 40.00 IS CODE = 1 DOWNSTREAM (FEET) 0.013 30.00 = 507.00 FEET 40.00 = 537.00 FEET 2.4 2.5 2.5 2.5 25.00 21.00 21.00 5.00 1.00 66.60 68.53 Page 12

Date: 06/13/11 File name: PROP-2.RES Page 13

(MIN.) 9.24 ********************************** ************************************* 0.0150 UPSTREAM ELEVATION(FEET) = 68.53 DOWNSTREAM ELEVATION(FEET) = 68.00 STREET LENGTH(FEET) = 115.00 CURB HEIGHT(INCHES) = 4.8 42.00 = 307.00 FEET. AREA-AVERAGED Fm(INCH/HR) = 0.08 Z AREA FP AP SCS (ACRES) (INCH/HR) (DECIMAL) CN Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199 DEPTH (FEET) = 0.22 HALFSTREET FLOOD WIDTH (FEET) = 6.24 FLOW VELOCITY (FEET/SEC.) = 1.14 DEPTH*VELOCITY (FT*FT/SEC.) = FLOW PROCESS FROM NODE 42.00 TO NODE 42.00 IS CODE = 81 0.23 FLOW PROCESS FROM NODE 41.00 TO NODE 42.00 IS CODE = 62 SCS SOIL AREA FP Ap GROUP (ACRES) (INCH/HR) (DECIMAL) GROUP (ACRES) (INCH/HR) (DECIMAL) 0.40 0.40 EFFECTIVE AREA (ACRES) = 0.42 AREA-AVERAGED FM (INCH/HR) AREA-AVERAGED FF (INCH/HR) = 0.20 AREA-AVERAGED AP = 0.40 TOTAL AREA (ACRES) = 0.42 PEAK FLOW RATE (CFS) = Ap TC(MIN.) = 10.98DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 5.00 SUBAREA RUNOFF(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA< 0.23 PEAK FLOW RATE(CFS) = **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1 0.20 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW< 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW: 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.441 Бp 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.441 1.10 1.00 TO NODE STREET PARKWAY CROSSFALL (DECIMAL) = 0.020 >>>> (STREET TABLE SECTION # 1 USED) <<<< AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.: PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = INSIDE STREET CROSSFALL (DECIMAL) = 0.020 0.19 0.23 5.75 SCS SOIL AREA STREET FLOW TRAVEL TIME (MIN.) = 1.75 SUBAREA TC AND LOSS RATE DATA(AMC I): END OF SUBAREA STREET FLOW HYDRAULICS: OUTSIDE STREET CROSSFALL (DECIMAL) STREET FLOW DEPTH(FEET) = 0.21 SCS SOIL SCS SOIL HALFSTREET FLOOD WIDTH(FEET) = SUBAREA LOSS RATE DATA(AMC I): SUBAREA LOSS RATE DATA(AMC I): 0.31 STREET HALFWIDTH (FEET) = 15.00 GROUP 0.19 Д Д LONGEST FLOWPATH FROM NODE MAINLINE TC(MIN) = 10.98 SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" SUBAREA AREA(ACRES) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = DEVELOPMENT TYPE/ DEVELOPMENT TYPE/ RESIDENTIAL

Page 14 (MIN.) ************************* 40.00 = 372.00 FEET. ELEVATION DATA: UPSTREAM(FEET) = 68.00 DOWNSTREAM(FEET) = 66.60 EFFECTIVE AREA (ACRES) = 0.49 AREA-AVERAGED Fm(INCH/HR) = 0.07 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.37 Ü 57 FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1 FLOW PROCESS FROM NODE 45.00 TO NODE 46.00 IS CODE = 62 40.00 IS CODE = 31 5.00 TO NODE 45.00 IS CODE = 21 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<< ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1 AREA FP AP : (ACRES) (INCH/HR) (DECIMAL) INITIAL SUBAREA FLOW-LENGTH(FEET) = 253.00 ELEVATION DATA: UPSTREAM(FEET) = 70.00 DOWNSTREAM(FEET) = 0.40 0.20 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.20 SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(CFS) = PEAK FLOW RATE(CFS) = SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 PEAK FLOW RATE (CFS) = >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<< CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE: >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA< Tc(MIN.) = 11.24FLOW LENGTH (FEET) = 65.00 MANNING'S N = 0.013 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000 File name: PROP-2.RES 0.20 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS< SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 0.20 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20 2.5 INCHES 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.597 09.0 1.00 TO NODE FLOW PROCESS FROM NODE 42.00 TO NODE SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 0.40 SUBAREA TC AND LOSS RATE DATA(AMC I): 4.17 EFFECTIVE STREAM AREA (ACRES) = 0.49 RAINFALL INTENSITY (INCH/HR) = 1.42 DEPTH OF FLOW IN 18.0 INCH PIPE IS TIME OF CONCENTRATION(MIN.) = 11.24 PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.49 AREA-AVERAGED Fm(INCH/HR) = 0.07 AREA-AVERAGED Fp(INCH/HR) = 0.20 SCS SOIL 0.26 PIPE-FLOW VELOCITY (FEET/SEC.) = 0.55 GROUP 0.40 0.49 Д TOTAL NUMBER OF STREAMS = 3 LONGEST FLOWPATH FROM NODE TOTAL STREAM AREA (ACRES) = 09.0 PIPE TRAVEL TIME (MIN.) = AREA-AVERAGED Ap = 0.37 FLOW PROCESS FROM NODE SUBAREA RUNOFF(CFS) = "8-10 DWELLINGS/ACRE" TOTAL AREA (ACRES) = PIPE-FLOW (CFS) = RESIDENTIAL Date: 06/13/11

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SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40 SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         STREET LENGTH (FEET) = 57.00 CURB HEIGHT (INCHES) = 4.8 STREET HALFWIDTH (FEET) = 15.00
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA
FLOW PROCESS FROM NODE
                                                                                                                                                                SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.20
SUBAREA AREA(ACRES) = 0.07 SUBAREA RUNOFF(CFS) =
                                                                                                                                                                                                                                                                                                                SUBAREA LOSS RATE DATA(AMC I):
DEVELOPMENT TYPE/ SCS SOIL
                                                                                                                                                                                                                                                                                                                                                                                                   MAINLINE TC(MIN) = 9.74
                                                                                                                                                                                                                                                                                                                                                                                                                                                          >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  FLOW PROCESS FROM NODE 46.00 TO NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LONGEST FLOWPATH FROM NODE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             FLOW VELOCITY(FEET/SEC.) = 1.75 DEPTH*VELOCITY(FT*FT/SEC.) = 0.36
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DEPTH(FEET) = 0.20 HALFSTREET FLOOD WIDTH(FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  EFFECTIVE AREA(ACRES) = 0.50 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              SUBAREA LOSS RATE DATA (AMC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           STREET FLOW TRAVEL TIME (MIN.) = 0.56
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0199
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              INSIDE STREET CROSSFALL(DECIMAL) = 0.020
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         UPSTREAM ELEVATION(FEET) = 68.18 DOWNSTREAM ELEVATION(FEET) = 67.50
                                                                                     TOTAL AREA(ACRES) =
                                                                                                           EFFECTIVE AREA(ACRES) = 0.57 AREA-AVERAGED Fm(INCH/HR) = 0.08 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.38
                                                                                                                                                                                                                             SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     END OF SUBAREA STREET FLOW HYDRAULICS:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  TOTAL AREA(ACRES) = 0.50
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     "8-10 DWELLINGS/ACRE"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        DEVELOPMENT TYPE/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       STREET FLOW DEPTH(FEET) = 0.20
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  AVERAGE FLOW VELOCITY (FEET/SEC.) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              HALFSTREET FLOOD WIDTH (FEET) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.544
                                                                                                                                                                                                                                                                                                                                                                       2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.544
                                                                                                                                                                                                                                                                                       LAND USE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LAND USE
                                                                                   0.57
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        SCS SOIL
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46.00 TO NODE
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                                                                                                                                                                                                                                                                               (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         (ACRES) (INCH/HR) (DECIMAL)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        AREA
                                                                                                                                                                                                                                                                                                                AREA
                                                                                   PEAK FLOW RATE(CFS) =
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               PEAK FLOW RATE (CFS) =
                                                                                                                                                                                                                                                           0.07
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           5.46
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40.00 IS CODE = 31
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  46.00 IS CODE = 81
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```

Date: 06/13/11 ELEVATION DATA: UPSTREAM(FEET) = 67.50 DOWNSTREAM(FEET) = 66 TIME OF CONCENTRATION(MIN.) = 9.88
RAINFALL INTENSITY(INCH/HR) = 1.53 FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.52 ESTIMATED PIPE DIAMETER(INCH) = 18.00 DEPTH OF FLOW IN 18.0 INCH PIPE IS >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW) <<<<< PEAK FLOW RATE (CFS) AT CONFLUENCE = TOTAL STREAM AREA(ACRES) = AREA-AVERAGED Fp(INCH/HR) = 0.20AREA-AVERAGED Fm(INCH/HR) = 0.08 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE: TOTAL NUMBER OF STREAMS = >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<< LONGEST FLOWPATH FROM NODE PIPE TRAVEL TIME (MIN.) = PIPE-FLOW(CFS) = ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000 FLOW LENGTH (FEET) = ** CONFLUENCE DATA ** EFFECTIVE STREAM AREA(ACRES) = AREA-AVERAGED Ap = NUMBER STREAM 2.95 9.83 3.03 10.91 3.04 11.12 3.04 11.15 3.01 11.82 2.94 12.54 0.60 11.24 0.75 9.88 (CFS) (MIN.) (INCH/HR) (INCH/HR) J.C 0.38 0.75 40.00 Intensity 1.535 0.20(0.08) 0.40 1.446 0.20(0.08) 0.40 1.431 0.20(0.08) 0.40 1.414 0.20(0.08) 0.40 1.382 0.20(0.08) 0.40 1.382 0.20(0.08) 0.40 1.382 0.20(0.08) 0.40 1.422 0.20(0.07) 0.37 1.531 0.20(0.08) 0.38 0.15 MANNING'S N = 0.013File name: PROP-2.RES 5.00 TO NODE 0.57 Tc(MIN.) = 9.88Fp (Fm) 2.7 INCHES NUMBER OF PIPES = 0.75 Αp 40.00 = 350.00 FEET. (ACRES) Āe HEADWATER NODE 21.00 21.00 5.00 1.00 5.00 25.00 25.00 66.60

CONFLUENCE FORMULA USED FOR 3 STREAMS.

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO

.,	•		4		, N	_	NUME	STRE	×
							H	MA	AK
4.2	4.3	4.3	4.3	4.3	4.2	4.2	(CFS)	Ю	LOW K
3 11.82	3 11.35	11.24	11.12	10.91	3 9.88	3 9.83		Tc	** PEAK FLOW KAIE TABLE **
1.382	1.414	1.422	1.431	1.446	1.531	1.535	(INCH/HR)	Intensity	*
0.20(0.20(0.20(0.20(0.20(0.20(0.20((INCH	Fp(
0.08)	0.08)	0.08)	0.08)	0.08)	0.08)	0.08)	/HR)	Fm)	
0.39	0.39	0.39	0.39	0.39	0.39	0.39		Αþ	
3.6	3.5	3.5	3.5	3.5	3.2	3.2	(ACRES)	Āе	
5.0	21.0	1.0	21.0	25.0	5.0	25.0	NODE	HEADWATER	
	1.382 0.20(0.08) 0.39 3.6	11.35	11.24 1.422 0.20(0.08) 0.39 3.5 11.35 1.414 0.20(0.08) 0.39 3.5 11.82 1.382 0.20(0.08) 0.39 3.6	11.12 1.431 0.20(0.08) 0.39 3.5 11.24 1.422 0.20(0.08) 0.39 3.5 11.35 1.414 0.20(0.08) 0.39 3.5 11.82 1.382 0.20(0.08) 0.39 3.6	10.91 1.446 11.12 1.431 11.24 1.422 11.35 1.414 11.82 1.382	9.88 1.531 0.20(0.08) 0.39 3.2 10.91 1.446 0.20(0.08) 0.39 3.5 11.12 1.431 0.20(0.08) 0.39 3.5 11.24 1.422 0.20(0.08) 0.39 3.5 11.35 1.414 0.20(0.08) 0.39 3.5 11.82 1.382 0.20(0.08) 0.39 3.5	9.83 1.535 0.20(0.08) 0.39 3.2 9.88 1.531 0.20(0.08) 0.39 3.5 10.91 1.446 0.20(0.08) 0.39 3.5 11.12 1.431 0.20(0.08) 0.39 3.5 11.24 1.422 0.20(0.08) 0.39 3.5 11.25 1.444 0.20(0.08) 0.39 3.5 11.82 1.382 0.20(0.08) 0.39 3.6	(MIN) (INCH/HR) (INCH/HR) (ACRES) NOD 9.33 1.535 0.20(0.08) 0.39 3.2 9.88 1.531 0.20(0.08) 0.39 3.2 10.91 1.446 0.20(0.08) 0.39 3.5 11.12 1.431 0.20(0.08) 0.39 3.5 11.12 1.431 0.20(0.08) 0.39 3.5 11.13 1.441 0.20(0.08) 0.39 3.5 11.23 1.444 0.20(0.08) 0.39 3.5 11.82 1.382 0.20(0.08) 0.39 3.5	Q TC Intensity Pp(Fm) Ap Ae HEADW (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NOD (4.28 9.83 1.535 0.20(0.08) 0.39 3.2 4.28 19.88 1.531 0.20(0.08) 0.39 3.5 4.34 11.12 1.446 0.20(0.08) 0.39 3.5 4.34 11.12 1.431 0.20(0.08) 0.39 3.5 4.34 11.12 1.431 0.20(0.08) 0.39 3.5 4.34 11.12 1.431 0.20(0.08) 0.39 3.5 4.33 11.35 1.446 0.20(0.08) 0.39 3.5 4.38 11.82 1.382 0.20(0.08) 0.39 3.5

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK PLOW RATE (CFS) = 4.34 TC(MIN.) = 11.12

EFFECTIVE AREA (ACRES) = 3.49 AREA-AVERAGED Fm(INCH/HR) = 0.08

AREA-AVERAGED FP(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.39

TOTAL AREA (ACRES) = 3.60

LONGEST FLOWPATH FROM NODE 5.00 TO NODE 40.00 = 537.00 FEET.

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<

Date: 06/13/11 File name: PROP-2.RES Page 17

FLOW PROCESS FROM NODE 40.00 TO NODE 50.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBARRA<<<<<
>>>>>SUSING COMPUTER-ESTIMATED PIPESIZE (NOW-PRESSURE FLOW) <<<<>

ELEVATION DART: UPSTREAM(FEET) = 66.60 DONNSTREAM(FEET) = 65.30 FLOW LENGTH (FEET) = 330.00 MANNING'S N = 0.013 DEPTH OF PLOW IN 18.01 INCH PIPE IS 10.9 INCHES PIPE-FLOW VELOCITY (FEET/SEC.) = 3.90 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1 PIPE-FLOW (CFS) = 4.34 TC (MIN.) = 12.53 LONGEST FLOWPATH FROM NODE 5.00 TO NODE 50.00 = 867.00 FEET.

END OF STUDY SUMMARY:

TOTAL ARBA (ACRES) = 3.60 TC (MIN.) = 12.53

REFECTIVE AREA (ACRES) = 3.49 AREA-AVERAGED FM (INCH/HR) = 0.08

AREA-AVERAGED AP = 0.39

PEAK FLOW RATE (CFS) = 4.34

** PEAK FLOW RATE TABLE **

STREAM Q TC Intensity Fp(FM) Ap Ae HEADWATER

NUMBER (CZE) (MIN.) (INCH/HE) (ACRES) NODE

1 4.28 | 11.25 | 1.421 | 0.20(0.08) 0.39 | 3.2 | 25.00

4 4.34 | 12.32 | 1.448 | 0.20(0.08) 0.39 | 3.5 | 25.00

4 4.34 | 12.53 | 1.349 | 0.20(0.08) 0.39 | 3.5 | 21.00

5 4.34 | 12.65 | 1.329 | 0.20(0.08) 0.39 | 3.5 | 21.00

6 4.33 | 12.76 | 1.322 | 0.20(0.08) 0.39 | 3.5 | 21.00

7 4.28 | 13.29 | 0.20(0.08) 0.39 | 3.5 | 21.00

8 4.13 | 12.55 | 1.255 | 0.20(0.08) 0.39 | 3.5 | 21.00

8 4.15 | 13.96 | 1.255 | 0.20(0.08) 0.39 | 3.6 | 5.00

END OF RATIONAL METHOD ANALYSIS

Date: 06/13/11

File name: PROP-2.RES

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NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS

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Analysis prepared by:

RBF Consulting 14725 Alton Parkway Irvine, CA 92618

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm) AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.05 (inches)

SOIL-COVER AREA PERCENT OF SCS CURVE LOSS RATE
TYPE (Acres) PERVIOUS AREA NUMBER Fp(in./hr.) YIELD
1 3.68 60.00 57.(75.) 0.200 0.366

TOTAL AREA (Acres) = 3.68

AREA-AVERAGED LOSS RATE, Fm (in./hr.) = 0.120

AREA-AVERAGED LOW LOSS FRACTION, Y = 0.634

1

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		Discontrol Helicabella Industria Ind

Page 1 Date: 06/13/11	4.93	5.14 0.0173 5.35 0.0181		5.98 0.0207	6.39 0.0225	6.60 0.0234			7.63 0.0282		8.48 0.0323			9.53 0.03578	9.74 0.0390		10.15 0.0414			10.39 0.0466		11.82 0.0523		12.45 0.0575		13.08 0.0638			14.12 0.0762	14.33 0.0792		14.75 0.0857			15.58 0.1053	15.79 0.1143			16.63 0.2242	17.04 0.2321		
		****	(000)	1264																				************	7.5 10.0																	,
PR~1.RES	4	PH MODEL	Convridt 1989-2001 Advanced Endinesving Coffeen	l License ID 1264	у:		٨			06.0			(dapti	(Nage)	USED	0			0.89				li	******	5.0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	,											į				
File name: HYD-PR~1.RES	4	SMALL AREA UNIT HYDROGRAPH MODEL	Adversary Day of	Release Date: 01/01/2001	Analysis prepared by:	RBF Consulting	14725 Alton Parkway	Irvine, CA 92618		ij	3.68		TIME OF CONCENTRATION(MIN.) = 12.53 DATIONAL METHOD DEAY FLOW DATE (12.53		ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE		RAINFALL VALUE (INCHES) =		RAINFALL VALUE (INCHES) = RAINFALL VALUE (INCHES) =		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	VOLUME (ACRE-FEET)	CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET)	********	2.5	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		٠		,		, ,		•	,							
Fi	***	TALL AREA	1006-086	kelease Da	Analys	RE	14725	Irvi		CBRATION C		0.634	N(MIN.)	YEA PEAK Q	Y" RAINFA	ARS) = 2 ATNFALI. VAI	AINFALL VA	AINFALL VA	AINFALL VA	VINFALL VA	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	RUNOFF VOI	TON SSOT-	*****	0.0	(FS)	0.00	0.04 0			0.04 0			0.04	0.04 0				0.04			0.05 Q
11	******	AIS								RATIONAL METHOD CALIBRATION COEFFICIENT	IOIAL CAICHMENT AREA(ACRES) : SOIL-LOSS RATE. FM. (TNCH/HR)	LOW LOSS FRACTION = 0.634	TIME OF CONCENTRATION(MIN.) = 12.53	IS USED FOR SMALL AREA PEAK Q	COUNTY "VALLE	RETURN FREQUENCY (YEARS) = 2 5-MINITE POINT RAINFALL VALUE (INCHES)	NUTE POINT RA	POINT	TNIOG		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TOTAL CATCHMENT RU	ATCHMENT SOII	**************	ы	(AF) (C	0.000.0	0.0000	0.0014	0.0020	0.0027	0.0041	0.0049	0.0056	0.0070	0.0078	0.0085	0.0093	0.0108	0.0116	0.0124	0.0132
Date: 06/13/11	***		(1))						RATIONA	SOIL-LOS	LOW LOS	TIME OF	IS USED	ORANGE (RETURN .	30-MINUTE	1-HOUR	3-HOUR	24-HOUR		TOTAL C	TOTAL CA	*******		(HOUKS)	0.13	0.34	0.76	96.0	1.17	1.59	1.80	2.01	2.43	2.63	2.84	3.05	3.47	3.68	3.89	4.10

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18.51	0.2474		Ø		
œ		0.08	Ø		
18.92	0.2502	0.08	0		
19.13	0.2514	0.07	Ø		
19.34	0.2527	0.07	Ø		
19.55	0.2538	0.07	Ю		
19.76	0.2550	0.06	0		
19.97	0.2560	0.06	Ø		
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Water Quality Management Plan (WQMP)

for:

Harbor Blvd. / Merrimac Way Project

Harbor Blvd. And Merrimac Way, Costa Mesa

Tentative Tract Number 17423

Prepared for:

Waterpointe Homes
190 Newport Center Drive, Newport Beach, California 92660

Prepared by:



14725 Alton Parkway, Irvine, Ca 92618 949-472-3505

June 14, 2011

JN 10-108016

Owner's Certification Water Quality Management Plan (WQMP)

Project Name: Harbor Blvd. / Merrimac Way Project

Tract/Parcel Map Number: 17423

This Water Quality Management Plan (WQMP) has been prepared for Waterpointe Homes by RBF Consulting. The WQMP is intended to comply with the requirements of the City of Costa Mesa Jurisdictional Urban Runoff Management Program and Stormwater Ordinance, as well as the Municipal Stormwater Permit that requires the preparation of WQMPs for priority development projects. This WQMP is in support of Tract Map No. 17423.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this WQMP. The undersigned will ensure that this plan is carried out and amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region Stormwater Runoff Management Program. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Signed:
Name: Garrett Calacci
Title: President
Company: Waterpointe Homes
Address: 190 Newport Center Drive, Newport Beach, California 92660
Telephone #: 949-644-8900
Date:
Fmail Address: garrett@waterpointehomes net

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Preface

This document, based on the City of Costa Mesa WQMP template, has been reformatted to better coincide with the requirements set forth in the new stormwater permits (Santa Ana RWQCB, R8-2009-0030). The reformatting follows the *Model Water Quality Management Plan (Model WQMP)*, Exhibit 7.II, and *Technical Guidance Document* (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs), Exhibit 7.III.

Section 1 Project Description

1. Detailed development description:

The project, Tentative Tract 17423, is a proposed 3.71 acre single family residential development consisting of 33 residential lots, 7 open space lots, and a private street. Improvements include drainage facilities, utilities, and on-site street improvements. Site topography is relatively flat (1% or less). The site is bounded on the west and south by Harbor Blvd and Merrimac Way, respectively. The site is bounded on the east by an apartment complex and on the north by a commercial lot and an apartment complex.

- 2. Project location and site address: The project is located at the southwest corner of the intersection of Harbor Blvd and Merrimac Way in the city of Costa Mesa, California. Assessors Parcel Numbers are 141-731-02, -03, 141-361-29, and -30. The project address is 2626 Harbor Blvd, Costa Mesa, CA.
- **3. Property size:** The project is approximately 3.71 acres.
- **4. Existing use:** The existing site is a local car sales business (zoning type C-1) and off-street parking (zoning type P).
- **5. Type of development:** The project is a residential development project, which is identified as a priority development project category in the new stormwater permits for the Santa Ana Regional Water Quality Control Board (RWQCB) of Orange County (R8-2009-0030).
- 7. **Property ownership:** As a planned community, residential lots will be individually owned and common areas (private driveways/streets, common landscaped areas, designated parking areas, etc.) shall be owned by a Home Owners Association.
- 8. Zoning and land use designation:

Existing Zone: C-1 and P

Proposed Zone: Residential Single Family Planned Development (RS-PD)

Existing Land Use: Commercial

Proposed Land Use: Medium Density Residential

9. Other:

Section 2 Project Location Map

The location of the project site is illustrated in Figures 1 and 2.

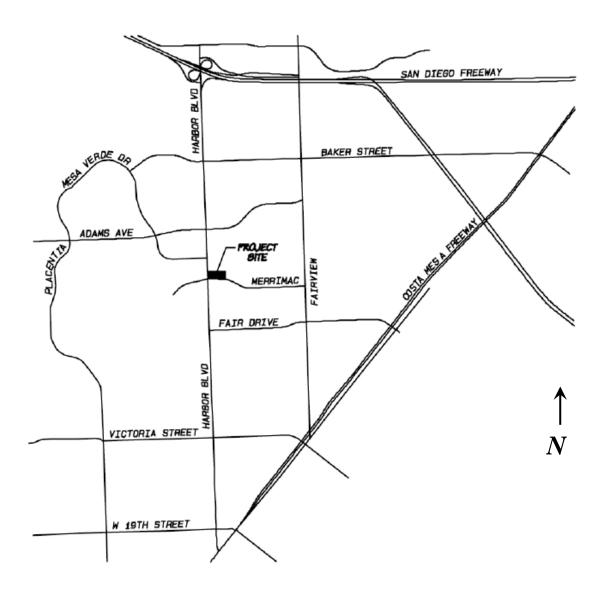
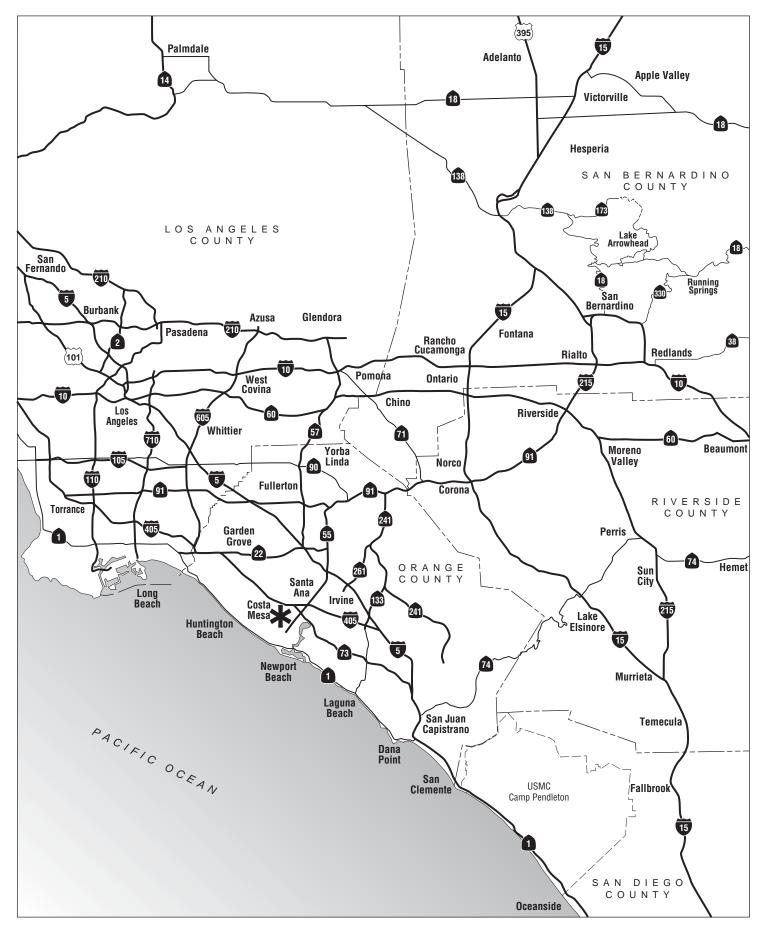


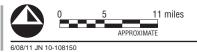
Figure 1 – Project Location Map

Thomas Brothers: Page 858, Grid J7

Not to Scale







2626 HARBOR BOULEVARD INITIAL STUDY/MITIGATED NEGATIVE DECLARATION



Figure 3 – Site Aerial (Google, 2011) Photograph

Section 3 Project Site Assessment and Constraints

This project site assessment and constraints section provides important information that is used when considering the potential water quality and hydrologic impacts that could be caused by the proposed project. This information is important when considering the appropriate BMPs to reduce identified potential impacts as well as when developing measures to reduce those impacts.

- 1. Project location and boundaries: The project is located at the southwest corner of the intersection of Harbor Blvd and Merrimac Way in the city of Costa Mesa, California. (Lat/Long: 33.66880, -117.91801). The site is within the Newport Bay Watershed within the Central County Watershed Management Area (OC Watershed F).
- 2. Topography, soil and vegetation: The site consists of relatively flat topography at an elevation approximately 70 feet above mean sea level. The soil type beneath the commercial lot is predominately hydrologic soil type D. Due to the existing commercial and parking lot land use, the site is entirely impervious except for the narrow strips of grass landscaping along Harbor Blvd and Merrimac Way.
- **3. Impervious/pervious surface areas:** The existing site is car sales and parking lot, thus nearly entirely impervious. The proposed developed surface area would be approximately 60% impervious.

Total Site Area $A_{Total} = 3.7$ Acres Impervious Area, $A_{Imp} = 2.2$ Acres

Pervious Area, $A_P = 1.5$ Acres

- **4. Locations of drainage from off-site:** The site does not capture any additional off-site drainage in either the existing or proposed conditions.
- Proposed pools, parks, open spaces, tot lots and any maintenance issues related to them: The seven proposed open spaces will be maintained by the Homeowner's Association (HOA). There are no proposed community pools.
- 6. Existing drainage and underground infrastructure: Existing site drainage is split between two areas: westerly one-third of the site drains to Harbor Blvd; the reminder of the site drains to Merrimac Way. There is no existing underground infrastructure. However, underground infrastructures are included as part of the project.
- 7. Environmentally Sensitive Areas (ESAs) and/or Areas of Special Biological Significance (ASBS):

Area Name	303(d)	RARE	ASBS
Paularino Channel F03			
Santa Ana-Delhi Channel F01			
Newport Bay, Upper	X	X	
Newport Bay, Lower	X	Х	
Pacific Ocean, Outlet			

303(d) – Water bodies required to be identified as not meeting water quality standards established for them, per Federal Clean water Act Section 303(d).

NCCP – Areas designated as preserves or their equivalent under the Natural Communities Conservation Program within the Cities and County of Orange (Coastal 3).

RARE – Water bodies designated with the RARE beneficial use by the State Water Resources Control Board. Rare, Threatened or Endangered Species (RARE) waters support the habitats necessary for the survival and successful maintenance of plant or

animal species designated under state of federal law as rare, threatened or endangered. **Areas of Special Biological Significance (ASBS)** – A state water quality protection area (SWQPA) where point source waste and thermal discharges shall be prohibited or limited by special conditions. Nonpoint source pollution shall be controlled to the extent practicable.

- **8.** Conditions/uses of adjacent parcels: The site is bounded on the west and south by Harbor Blvd and Merrimac Way, respectively. The site is bounded on the east by an apartment complex and on the north by a commercial lot and an apartment complex.
- 9. Soil type(s) and geologic information: The underlying soil onsite is predominantly Soil Group D according to the Natural Resources Conservation Service (NRCS) Web Soil Survey and Orange County Hydrologic Soil Map. The soil consists of 83% Cropley Clay and 17% Myford Sandy Loam according the Natural Resources Conservation Service Web Soil Survey.
- **10. Geotechnical considerations:** A geotechnical report will be prepared for this project at a later phase and will be submitted as required by the City.
- 11. Feasibility of infiltration, evapotranspiration, or harvest and use: Infiltration is not feasible given the preliminary soil condition being predominately clay (or soil type D). Evapotranspiration is not feasible due to undetermined maintenance in the given climate and excessive cost.

Harvest and use is feasible but not effective because sufficient demand for harvested rainwater is not present. Only seven common open space areas (approximately 0.27 acres) are present and scatter across the 3.7 acre site. There will be little to no landscape irrigation demand exists after an 85th percentile storm event.

12. Watershed and receiving waters: The site drains to Watershed F San Diego Creek and Watershed G Newport Bay. The receiving waters downstream of the site are the following: Paularino Channel F03:

Santa Ana-Delhi Channel F01;

Newport Bay, Lower;

Pacific Ocean, Outlet.

13. 303(d) listed receiving waters: Newport Bay, Lower is a 303(d) Listed Water Body. This site does not directly discharge to nor is the discharge point within 200 feet of a 303(d) Water Body.

Section 4 Pollutants of Concern

This section of the water quality management plan identifies primary and secondary pollutants of concern. Pollutants of concern are those that are anticipated to be generated by the proposed project. Pollutants of concern are differentiated between primary and secondary depending on the condition of downstream receiving waters. If the project will drain to a receiving water that is impaired for a pollutant anticipated from that project, that pollutant is a primary pollutant of concern. Pollutants frequently identified on the 303(d) list of California impaired water bodies include metals, nitrogen, nutrients, indicator bacteria, pesticides and trash (see 303(d) List). In some cases, there may be specific conditions (i.e. other known water quality problems) that warrant identifying an anticipated pollutant as a primary pollutant of concern. If there is no corresponding impairment or other water quality problem in the receiving waters for an anticipated pollutant, the pollutant is a secondary pollutant of concern.

Table 4.1 Potential Pollutants for Project Categories

- 1. Project land use categories: Anticipated and potential pollutants generated by detached residential developments include sediments, nutrients, pathogen (bacteria/virus), pesticides, oil & grease, and trash & debris (Reference: Table 7.II.1 of OC Model WQMP; see Appendix A).
- 2. Total Maximum Daily Loads (TMDLs) for receiving waters: The TMDLs that have been established for Newport Bay, Upper are: Metals, Nutrients, Pathogens, Pesticides, and Sediments. The TMDLs that have been established for Newport Bay, Lower are: Metals, Nutrients, Pathogens, and Pesticides
- **3. Project watershed information:** Pollutants identified in the 303(d) list for impaired water bodies are as follows:

Water Body	2006 List	2010 List
Newport Bay,	Metals, Nutrients,	Metals, Nutrients,
Upper	Pesticides, Toxicity,	Pesticides, Toxicity,
	Turbidity, Other Organics	Turbidity, Other Organics
Newport Bay,	Metals, Nutrients,	Nutrients, Pesticides,
Lower	Pesticides, Toxicity,	Toxicity, Other Organics
	Other Organics	

4. Primary pollutants of concern:

Newport Bay, Upper: Nutrients, Pathogens (bacteria/virus), Pesticides, and Sediments Newport Bay, Lower: Nutrients, Pathogens (bacteria/virus), and Pesticides

Secondary pollutants of concern: Trash & debris, oxygen demanding substances, and oil & grease.

Section 5 Hydrologic & Geotechnical Conditions of Concern

This section of the water quality management plan identifies hydrologic and geotechnical conditions of concern related to the proposed project. Hydrologic or geotechnical conditions of concern are identified through a review of on-site and downstream drainage paths. If the proposed project would cause or contribute flows to problems along on-site or downstream drainage paths, these problems or future problems are considered conditions of concern. Conditions of concern can include problems such as flooding, erosion, scour, and other impacts that can adversely affect channel and habitat integrity.

In order to identify conditions of concern, a comprehensive understanding of flow volume, rate, duration, energy, and peak flow is necessary. Often, a formal drainage study is necessary which considers the project area's location in the larger watershed, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and any other relevant hydrologic and environmental factors. As part of the study, the drainage report includes:

- Field reconnaissance to observe downstream conditions
- Computed rainfall and runoff characteristics including a minimum of peak flow rate, flow velocity, runoff volume, time of concentration and retention volume
- Establishment of site design, source control and treatment control measures to be incorporated and maintained to address downstream conditions of concern

A hydrology study was prepared for the proposed project by RBF Consulting, as required by the City, and is included as Appendix B. A summary of the drainage report is provided in the table below.

A geotechnical report will be prepared for this project at a later phase and will be submitted as required.

- **1. MS4 permit**: The project site shall satisfy the requirements of Santa Ana (Region 8) Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0030.
- 2. Watershed Master Plan (WMP): San Diego Creek (Watershed F) and Newport Bay (Watershed G) have a Watershed Master Plan.
- 3. Project watershed information: The San Diego Creek Watershed is approximately 86,822 acres. It includes the cities of Costa Mesa, Irvine, Laguna Hills, Laguna Beach, Costa Mesa, Newport Beach, Orange, Santa Ana and Tustin, as well as unincorporated portions of Orange County. The Newport Bay Watershed is approximately 10,025 acres. It includes the cities of Costa Mesa, Newport Beach, and unincorporated portions of Orange County.
- 4. Susceptibility to Hydrologic Conditions of Concern (HCOCs):

 Per the North Orange County Permit, this project does not have the potential to have an HCOC because 1)the site imperviousness has been decreased from 90% to 60%; 2)all downstream channels (Paularino Channel F03 and Santa Ana-Delhi Channel F01) are engineered, hardened and regularly maintained.

- **5.** Relevant hydrologic and environmental factors: The site is adjacent to developed land (residential and commercial area). The project site does not receive runoff from the adjacent parcels.
- 6. Proposed hydrologic conditions: The developed site will have a decrease in runoff due to a decrease in impervious area. The existing condition is approximately 90 percent impervious compared to approximately 60 percent impervious in the proposed condition. Runoff in the existing condition is mainly in the form of sheet flow across variable flat and shallow grades, whereas runoff in the proposed condition will be curb flow and conveyed with an underground storm drain system.
- 7. Significant impact on downstream channels and habitat integrity: Due to the proposed BMP and a decrease in site imperviousness, the proposed project is not anticipated to have significant impacts to downstream receiving water bodies.

8. Applicable design capture storm depth:

Design capture storm depth is 0.76".

(Reference: Appendix A. Figure 6.2 of Technical Guidance Document)

- **9.** Categorize magnitude of HCOCs for project planning: Hydrologic conditions of concern do not exist for this project.
- **10. Identify the hierarchy of BMPs that shall be used:** Retain on-site 80% of average annual stormwater runoff, OR
 - a. Retain stormwater runoff on-site (infiltrate, harvest and use, or evapotranspiration)
 - b. Recover storage volume as soon as possible after a storm event (drawdown)
 - c. <u>Biotreat</u> the remaining runoff volume on-site to achieve 80% average annual capture efficiency
 - d. Retain or biotreat remaining runoff volume in a regional facility to achieve 80% average annual capture efficiency
 - e. Fulfill alternative compliance obligations

11. Project hydrology analysis:

2-year storm analysis summary

	Q _{2-yr} (cfs)	V _{2-yr} (ac-ft)	T _{c,2-yr} (min)
Predevelopment	4.82	0.45	11.72
Postdevelopment	4.34	0.27	12.53
% Difference	-10.0%	-40.0%	6.9%

The hydrology analysis parameter for the 2-year storm and additional hydrology analysis for the 10-, 25-, and 100-year storms can be found in the attached hydrology report prepared by RBF Consulting (June 13, 2011).

5.1 Identify Whether HCOCs Exist

HCOCs for North County

Per the Santa Ana RWQCB's Order No. R8-2009-0030, HCOCs are considered to exist if streams are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exist:

	Condition	Yes	No	Calculations
1	Post-development runoff volume for the 2-yr, 24-hr storm exceeds that of the predevelopment condition by more than 5 percent.		Х	V _{2-yr,pre-development} = 0.45 ac-ft V _{2-yr,post-development} = 0.27 ac-ft Change = -40% < +5% Condition does not exist
2	Time of concentration of post-development runoff for the 2-year, 24-hour storm event is less than the time of concentration of the predevelopment by more than 5 percent.		X	$\begin{split} T_{c,2\text{-yr,pre-development}} &= 11.7 \text{ min} \\ T_{c,2\text{-yr,post-development}} &= 12.5 \text{ min} \\ \text{Change} &= 6.9\% > 5\% \\ \text{Condition does not exist} \end{split}$

Per the above calculations, hydrologic conditions of concern do not exist for this project.

Section 6 Best Management Practices (BMPs)

Minimizing a development's effects on water quality and the environment can be most effectively achieved by using a combination of Site Design Principles, Low Impact Development (LID) BMPs, Source Control BMPs and Treatment control BMPs. The strategy consists of: 1) reducing or eliminating post-project runoff; 2) controlling sources of pollutants; and 3) treating stormwater runoff before discharging it to the storm drain system or to receiving waters.

This WQMP and the proposed BMPs for the proposed project have been developed to minimize drainage impacts identified in Section 5 and the introduction of pollutants identified in Section 4 into the municipal storm drain system and/or ultimate drainage receiving water body.

For more detailed information on the use and design of BMPs please see the California Stormwater Quality Association New development and Redevelopment handbook. The handbook is available at www.cabmphandbooks.com. Additional information is also available in the City's LIP.

6.1 Site Design Principles and Techniques

LID site design practices can be implemented to reduce the volume of stormwater runoff generated on a project site as well as improve the quality of runoff that leaves the site. These are considered "preventative" aspects of LID, and, if implemented in the site design at the earliest phases of the project planning process, can result in smaller LID, source control, treatment control, and/or hydromodification control BMPs.

6.1.1 Maximize natural infiltration capacity

- 1. Take advantage of Hydrologic Soil Group A or B and in some cases Group C: The underlying soil onsite is over 80% Soil Group D according to NRCS Web Soil Survey. The site design incorporates various LID BMPs to the maximum extent possible.
- 2. Use mild slopes or depressions: The project site is located on a mild slope location. The proposed street slope at 0.4%. LID BMPs are strategically located at low drainage points. Open space and residential yards will use mild slopes.
- **3. Minimize unnecessary compaction:** The site shall minimize unnecessary compaction except for the areas recommended by the geotechnical report.
- **4. Minimize construction footprint:** Although construction will occur across the entire site for rough grading and soil stability purposes, LID BMPs will be incorporated to the maximum extent possible.
- **5. Use permeable paving materials:** Per the NRCS Web Soil Survey's preliminary soil group being mostly clay, infiltration type BMP such as permeable paving material is not feasible.

6.1.2 Preserve existing drainage patterns and time of concentration

- 1. Avoid channelization of natural streams: No natural streams exist on the site in either the pre-developed or post-developed conditions.
- 2. Use mild slopes and increase channel roughness to extend time of concentration:
 No channels exist on the site. Runoff shall be conveyed through a storm drain system with a longer travel path in the proposed condition than in the pre-developed condition, thereby extending the time of concentration.
- 3. Use pervious channel linings to maximize opportunity for infiltration: No channels exist on the site in either the pre-developed or post-developed conditions.
- **4. Use vegetated, un-hardened conveyance elements:** Vegetated, un-hardened conveyance elements are proposed on each residential unit.
- **5. Intersperse localized retention features throughout site:** Each of the proposed residential units has disconnected impervious areas that promote localized bioretention.

6.1.3 Protect existing vegetation and sensitive areas

- 1. Establish set-backs and buffer zones surrounding sensitive areas: The proposed development is on an existing car sales lot and surrounded by commercial and residential properties, thus no sensitive areas exists.
- **2. Incorporate established trees into site layout:** No established trees already exist on the pre-developed site. However, trees shall be planted in the proposed development.
- 3. Use native or drought tolerant trees and shrubs: Climate- and location-appropriate trees shall be planted per landscape architect recommendations. This project shall use drought tolerant vegetation and/or trees where possible.
- **4. Incorporate landscaped buffers:** Open space lots approximately 2,580 ft² in size shall provide a buffer between the development. Proposed landscape strips will act as a setback from the street sidewalk.
- **5. Conservation of natural areas:** The proposed development is on an existing car sales (90% impervious), thus conservation of natural area does not apply.

6.1.4 Minimize Impervious Area

- 1. Minimize building footprint: The homes shall be up to 2-stories in height, minimizing the horizontal building footprint. In addition, the project layout has created a significant landscape area around the perimeter of each residence. There are frontage yards and side yards, and most of the project perimeter is landscaped.
- 2. Reduce road widths:
 - The road widths for all residential streets within the project are designed to the City of Costa Mesa standard for local streets.
- Minimize lot setbacks and driveway lengths: Lot setbacks have been minimized to provide minimal driveway lengths while still satisfying maximum grade requirements for driveways.

4. Minimize impervious area of sidewalks, driveways and parking areas: The sidewalk width shall be minimized, but still satisfies requirements per the Americans with Disabilities Act. Resident driveways parking areas shall be minimized where possible.

6.1.5 Disconnect impervious areas

- 1. Provide permeable areas within medians and parkways that are designed to accept runoff from adjacent areas: The site has no medians or parkways. However, the lack of parkways allows for more room for continuous front yard landscaping for each residence.
- 2. Construct roof downspouts to drain to pervious areas: Roof drain downspouts are to be drained to pervious areas around the residential lots. Splash pads are to be incorporated to prevent erosion.
- 3. Use vegetated drainage swales: Vegetated drainage swales will be used where possible.
- 4. Incorporate permeable areas into site drainage system: All roof runoff will be drained to pervious landscaped areas around the residential lots, and conveyed through pervious vegetated swales to the driveways.
- 5. Use permeable paving materials on driveways, parking areas and sidewalks: The site design does not have sidewalks or street parking, thus reducing the roadway system impervious area. Permeable paving materials shall be used on driveways where possible.

6.1.6 Minimize construction footprint

- 1. Minimize the amount of site clearing and grading: The existing site is a car sales lot (90% impervious), thus nearly all of the site area will have to disturbed. However, the proposed development will significantly reduce the imperviousness as a result.
- 2. Minimize soil compaction from heavy construction equipment: Soil shall be compacted per the geotechnical report recommendations.
- **3.** Clearly define protection areas: The undisturbed area, if any, shall be clearly defined on site plans.

6.1.7 Revegetate disturbed areas

- 1. Maximize canopy interception to reduce erosive potential of precipitation: The project perimeter and residential street perimeters shall have grass, shrubs, and/or trees planted per the landscape architect's design to provide a canopy for interception of precipitation.
- 2. Establish a healthy plant and soil community to assist with pollutant remediation: Landscape architect plans will identify a concept plant schedule for the proposed landscape and open space areas. Maximized pervious area throughout the project shall provide biofiltration opportunities.
- 3. Establish a thick vegetative cover to maintain soil infiltration rates: Vegetation cover will be provided at the landscaping areas and open space lots, but little infiltration are expected given the soil type from NRCS Web Soil Survey. Trees and landscaping at each residence shall also provide vegetative cover.

6.2 Low Impact Development BMPs

Low Impact Development (LID) performance criteria prioritize the use of BMPs as follows: Hydrologic Source Controls (HSC), Infiltration, Harvest and Use, Evapotranspiration, and Biotreatment. Feasibility Screening is performed to determine which of these BMPs are suitable for consideration in developing an integrated stormwater design. This section describes the Feasibility Screening process and summarizes which BMPs are determined feasible for the given project site.

6.2.1 Level 1 Feasibility Screening Process

Below is a table summarizing BMP selection and prioritization as a result of the Level 1 Feasibility Screening Process. The reference for the Level 1 Feasibility Screening Process is the hydrologic source control fact sheets in the Technical Guidance Document and the California Stormwater BMP Handbook.

Infiltration on the site is not feasible due to the soil type. However, the San Diego watershed Hydromodification Management Plan states the following: "Even if infiltration is shown to be infeasible, LID facilities can be designed as filtration-type or evaporation-type facilities instead of infiltration-based facilities." This concept has been applied to some of the LID BMPs described below.

Table 6.1 Level 1 Feasibility Screening Process					
Assessment	Level 1 Feasibility Screening Results	Opportunity for drainage area	Priority Level	Implement?	
Key to Ranking	/ Shall O May X Shall Not	X = No Opportunity H, M, L = Level of Suitability	/ + H = Priority 1 / + M = Priority 2 / + L = Priority 3 O + H,M,L = Priority 3	Yes / No	
Hydrologic Source Controls					
Localized on-lot infiltration	0	M	3	No	
Impervious area dispersion	0	М	3	Yes	
Street trees / Canopy cover	0	Н	3	Yes	
Residential rain barrels not actively managed	0	L	3	No	
Infiltration BMPs					
Bioretention without Underdrains / Rain	0	L	3	No	
Infiltration Basin	0	L	3	No	
Infiltration Trench / French Drain	0	L	3	No	
Dry Well	0	L	3	No	
Underground Infiltration	0	L	3	No	
Permeable Pavement	0	L	3	No	
Harvest and Use BMPs					
Harvest and Use for Landscape Demand	Х	Х	3	No	
Harvest and Use for Indoor Demand	X	X	3	No	
Harvest and Use for Mixed Demand	X	X	3	No	
Harvest and Use for Other Demand	X	X	3	No	
Biotreatment BMPs					
Bioretention with Underdrains	/	M	2	No	
Vegetated Swales	/	M	2	No	
Vegetated Filter Strips	/	M	2	No	
Constructed Wetlands	/	L	3	No	
Proprietary Biotreatment	/	Н	1	Yes	

6.2.2 Hydrologic Source Controls

- **1. Localized on-lot infiltration:** The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate.
- 2. Impervious area dispersion: Roof downspout dispersion techniques shall be implemented for each residence where feasible. Although the soil type is not uniformly conducive to infiltration, dispersing the roof runoff onto adjacent landscaping areas will provide other benefits: lengthen the runoff travel time and control the peak flow; provide evapotranspiration during the lengthened travel; and provide some natural infiltration, storage and pollutant removal due to the inherent properties of grass and landscaping. Splash pads are to be incorporated to prevent erosion of landscaped areas.
- 3. Street trees / canopy cover: Street trees shall be incorporated into the site design along the residential streets and the perimeter of the project site. Street tree canopy interception will provide the following benefits: lengthen the runoff travel time and control the peak flow and provide evapotranspiration.
- **4. Residential rain barrels (not actively managed):** The project site does not provide sufficient vegetated areas to require stored water to be used for irrigation. No landscape irrigation demand exists for periods of longer than 1 week following an 85th percentile, 24-hour storm event. Furthermore, allowing roof downspouts to disperse onto a pervious area will provide better runoff and pollutant control given the site conditions and layout.

6.2.3 Infiltration BMPs

- **5. Bioretention without underdrains / rain:** The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate.
- **6. Infiltration basin:** The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate. The majority of the site will not be on native soil, making an infiltration basin infeasible.
- 7. Infiltration trench / French drain: The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate. The majority of the site will not be on native soil, making infiltration trenches infeasible.
- **8. Dry well:** The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate. The majority of the site will not be on native soil, making dry wells infeasible.
- **9. Underground infiltration:** The soil type is not uniformly conducive to infiltration. The majority of the site will not be on native soil, making underground infiltration infeasible.
- **10. Permeable pavement:** The soil type is not uniformly conducive to infiltration, thus making the permeable pavement infeasible.

6.2.4 Harvest and Use BMPs

11. Harvest and use for landscape demand: No landscape irrigation demand exists for periods of longer than 1 week following an 85th percentile, 24-hour storm event, and the project is single family residential land use with density 9 dwelling units per acre. Due to insufficient demand, harvest and use systems are not beneficial.

- **12.** Harvest and use for indoor demand: The site is not designated for reclaimed water use for irrigation and/or toilet flushing. Insufficient indoor use demand is available for harvested stormwater use.
- **13. Harvest and use for mixed demand:** Due to the reasons mentioned above, harvest and use systems are not beneficial for the project site.
- **14.** Harvest and use for other demand: Due to the reasons mentioned above, harvest and use systems are not beneficial for the project site.

6.2.5 Biotreatment BMPs

- **15. Bioretention with underdrains:** Proprietary bioretention planter boxes with underdrains are incorporated into the site design.
- **16. Vegetated swales:** Vegetated swales shall be considered for each residence for rooftop runoff dispersion for pollutant removal and flow velocity reduction. However, they may not be designed to the recommended length, width and infiltration capabilities due to lot size and soil restrictions mentioned above.
- 17. **Vegetated filter strips**: Not enough pervious sheet flow condition along the proposed street for this BMP to be considered. Vegetated strips shall be considered for each residence for rooftop runoff dispersion for pollutant removal and flow velocity reduction.
- 18. Constructed wetlands: Due to lack of perennial water source to maintain the permanent pool, constructed wetland is not feasible.
- 19. Proprietary biotreatment: Proprietary bioretention planter boxes with underdrains are incorporated into the site design. This BMP provides water quality treatment by means of pollutant and sediment removal, a filter media for bacteria removal, and the roots for the nutrient removal.

6.3 Source Control BMPs

Source Control BMPs are measures focusing on reducing or eliminating post-project runoff and controlling sources of pollutants. Source Control BMPs must be included in all projects and can be represented in structural measures such as landscape, irrigation, signage considerations, materials, and design of areas; and non-structure measures such as requirements, cleaning, education, and maintenance.

	Table 6.2 Source Control Non-Structural BMPs	
Number	BMP and Objective	Included
Routine	Non-Structural BMPs	
N1	Education for Property Owners, Tenants and Occupants: Practical informational materials are provided to residents, occupants, or tenants to increase the public's understanding of stormwater quality, sources of pollutants, and what they can do to reduce pollutants in stormwater. Explanation/Description: Educational materials for residents are an important part of improving storm water quality. Orange County's Watershed Program provides	Y
	educational material for residents (see Appendix C). Further information and stormwater quality brochures can be found at: http://www.ocwatersheds.com/PublicEd/	
N2	Activity Restrictions: Rules or guidelines for developments are established within appropriate documents (i.e. CC&Rs, lease terms, etc.) which prohibit activities that can result in discharges of pollutants.	Y
	Explanation/Description: CC&Rs are to be determined prior to final submittal.	
N3	Common Area Landscape Management: Specific practices are followed and ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water, and reduce pesticide and fertilizer applications.	Y
	Explanation/Description: The Homeowners' Association (HOA) will be responsible for maintenance of the common landscaped areas onsite.	
N4	BMP Maintenance: In order to ensure adequate and comprehensive BMP implementation, all responsible parties are identified for implementing all non-structural BMPs and for structural BMPs, cleaning, inspection, and other maintenance activities are specified including responsible parties for conducting such activities.	Y
	Explanation/Description: The HOA will be responsible for onsite BMP maintenance per Operations and Maintenance Plan (see Section 8.1).	
N5	Title 22 CCR Compliance: Hazardous waste is managed properly through compliance with applicable Title 22 regulations.	N
	Explanation/Description: N/A. Title 22 does not apply, as this is not a community care facility.	
N6	Local Water Quality Permit Compliance: The project complies with water quality permits issued by the City to ensure clean stormwater discharges.	Y
	Explanation/Description: The project will comply with all water quality permits issued by the city, County, State, etc.	

N7	Spill Contingency Plan: A Spill Contingency Plan is implemented to ensure that spills are managed properly by requiring stockpiling of cleanup materials, notification of responsible agencies, disposal of cleanup materials, documentation, etc.	N
	Explanation/Decernition, Net applicable because this is a residential development	
N8	Explanation/Description: Not applicable because this is a residential development. Underground Storage Tank Compliance: Because of the known or potential	N
NO	presence of underground storage tanks (USTs) on the project site, applicable UST regulations apply and are adhered to in order to avoid harm to humans or the environment.	N
NO	Explanation/Description: No USTs exist onsite.	N.I.
N9	Hazardous Materials Disclosure Compliance: Because hazardous materials or wastes will be generated, handled, transported, or disposed of in association with the project, measures are taken to comply with applicable local, state, and federal regulation to avoid harm to humans and the environment. Explanation/Description: Not applicable because this is a residential development.	N
NAO	Heife was Fire On de language estation. The analysis of includes a beautiful and a second constraint.	
N10	Uniform Fire Code Implementation: The project includes a hazardous material storage facility or other area regulated by Article 80 and therefore implements measures to comply with this section of the Uniform Fire Code.	N
	Explanation/Description: Hazardous material storage facility or other similar	
	facility, regulated by Article 80, not included in site design.	
N11	Common Area Litter Control: Trash management and litter control procedures are specified, including responsible parties, and implemented to reduce pollution of drainage water. Explanation/Description: The HOA is responsible for all Common Area	Y
	maintenance.	
N12	Employee Training: Practical informational materials and/or training are provided to employees to increase their understanding of stormwater quality, sources of pollutants, and their responsibility for reducing pollutants in stormwater.	N
N13	Explanation/Description: Not applicable because this is a residential development. Housekeeping of Loading Docks: Cleaning and clean up procedures are	
NIS	specified and implemented for loading dock areas to keep the area free for pollutants and reduce associated pollutant discharges. Explanation/Description: Loading docks are not incorporate in the site design.	N
N14	Drainage Facility Inspection: Inspection procedures, schedules, and	
	responsibilities are established for drainage facilities to ensure regular cleaning, inspection, and maintenance. Explanation/Description: The HOA is responsible for all Drainage Facility	Υ
	Inspection and Maintenance. Inspection and Maintenance procedures are outlined in the Operation and Maintenance Plan found in Section 8.1.	
N15	Street Sweeping Private Streets and Parking Lots: Street sweeping frequency and responsible parties are identified and regular sweeping is conducted to reduce pollution of drainage water.	Y
	Explanation/Description: Street sweeping frequency and responsible parties are identified and regular sweeping is conducted to reduce pollution of drainage water.	

N17	Retail Gasoline Outlets: Specific operational and maintenance BMPs are implemented to the extent feasible to reduce potential for pollutant discharge from wash off by runoff, leaks, and spills.	N
	Explanation/Description: Gasoline outlets are not part of this project.	

	Table 6.3 Source Control Structural BMPs			
Number	BMP and Objective	Included		
Source	Control Structural BMPs (numbers correspond to the California BMP Ha	ndbook)		
SD-10	Site Design and Landscape Planning: Landscape planning methodologies are incorporated into project design to maximize water storage and infiltration opportunities and minimize surface and groundwater contamination from stormwater.	Y		
	Explanation/Description: Landscaped areas have been maximized in the site layout to provide first contact infiltration and reduce impervious surfaces where practical.			
SD-11	Roof Runoff Controls: Direct roof runoff away from paved areas and to pervious areas, cisterns, infiltration trenches, and/or storage areas for reuse to reduce total volume and rate of site runoff and retain pollutant on site.	Y		
	Explanation/Description: Roof drain downspouts are to be directed to landscaped areas around residential lots. Splash pads shall be provided at downspout outlet to prevent erosion of landscaped areas.			
SD-12	Efficient Irrigation: Project plans include application methods to minimize irrigation water discharged into stormwater drainage systems. Explanation/Description: Landscaped common areas shall be irrigated efficiently to reduce dry weather runoff. Common area irrigation is to be maintained by the HOA. Residents are to be educated on efficient irrigation practices to minimize residential dry weather runoff.	Y		
SD-13	Storm Drain System Signs: Stencils or affixed signs a placed adjacent to storm drain inlets to prevent waste dumping at storm drain inlets. Explanation/Description: All catch basins are to be equipped with "No Dumping – Drains to Ocean" stencils and/or placards.	Y		
SD-20	Pervious Pavements: Porous concrete or asphalt, blocks with pervious spaces or joints, or grass or gravel surfaces are employed to reduce runoff volume and provides treatment. Explanation/Description: Permeable concrete pavers are to be incorporated at the "A" Street entrance and at the bulbs of the cul-de-sacs of "C" and "E" Streets where guest parking is provided.	Y		
SD-21	Alternative Building Materials: Specialized building materials are employed that have lower potential to leach pollutants, and reduce need for future painting or other pollutant generating maintenance activities. For example, some treated wood contains pollutants that can leach out to the environment and some metal roofs and roofing materials result in high metal content in runoff. Explanation/Description: Water quality is to be considered when selecting building	Y		

	materials and using equipment during construction operations.	
SD-30	Fueling Areas: Project plans are developed for cleaning, spill cleanup, containment, leak prevention, and incorporation of design to reduce rain and	
	runoff that could come in contact with fueling areas.	N
	Explanation/Description: N/A. Fueling areas will not be incorporated in this residential development.	
SD-31	Maintenance Bays and Docks: Project design incorporates measures to cover or otherwise eliminate run-on and off from bays and docks, and direct connections to storm drain are eliminated.	N
	Explanation/Description: N/A. Maintenance bay/docks will not be incorporated in this project.	
SD-32	Trash Enclosures: Trash storage areas are covered and enclosed to prevent introduction of trash and debris to site runoff.	N
	Explanation/Description: Each residence will be equipped with individual containers for trash, recycling, and green waste.	IN
SD-33	Vehicle and Equipment Washing Areas: Designated wash areas or facilities are contained and wash water is reused, treated, or otherwise properly disposed of.	Y
	Explanation/Description: S.W.P.P.P. shall address Vehicle and Equipment Washing Areas for use during construction operations.	·
SD-34	Outdoor Material Storage Areas: Outdoor storage areas for materials containing pollutants, especially hazardous materials, are covered and enclosed, on impervious surfaces, and include secondary containment when applicable.	Υ
	Explanation/Description: S.W.P.P.P. shall address Outdoor Material Storage Areas for use during construction operations.	
SD-35	Outdoor Work Areas: Outdoor work areas are covered, contained, and treated as necessary to reduce opportunity of pollutants from work activities to enter stormwater.	N
	Explanation/Description: N/A. Outdoor Work Areas will not be incorporated in this design.	
SD-36	Outdoor Processing Areas: Outdoor processing areas are covered, contained, and treated as necessary to reduce opportunity of pollutants from work activities to enter stormwater.	N
	Explanation/Description: N/A. Outdoor Processing Areas will not be incorporated in this design.	

6.4 Treatment Control BMPs

Per the Santa Ana RWQCB's Order No. R8-2009-030 NPDES No. CAS618030 for the City of Costa Mesa and Co-permittees, the water quality "...mitigative measures should be prioritized with the highest priority for BMPs that remove storm water pollutants and reduce runoff volume, such as infiltration, then other BMPs, such as harvesting and reuse, evapotranspiration and bio-treatment should be considered. These LID BMPs must be implemented at the project site in a manner consistent with the maximum extent practicable standard. Where LID BMPs are not feasible at the project site, more traditional, but equally effective control measures should be implemented." The permit requires "...that each priority development project infiltrate, harvest and re-use, evapotranspire, or bio-treat the 85th percentile storm event..." and states that "A properly engineered and maintained bio-treatment system may be considered only if infiltration, harvesting and reuse and evapotranspiration cannot be feasibly implemented at a project site."

Treatment control BMPs consist of public domain BMPs (identified in the following table with as TC-##) and manufactured or proprietary BMPs (identified in the following table with as MP-##). BMP numbers correspond to the California BMP Handbook.

The following table identifies the treatment control BMPs included in the proposed project.

Table 6.4 Treatment Control BMPs				
Number	BMP and Objective	Included		
	Infiltration			
TC-10	Infiltration Trench: A long narrow rock filled trench with no outlet receives water and stores it until it infiltrates into the underlying soil. Its effective are removing most pollutants but can get clogged with sediment.	N		
	Explanation/Description: The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate.			
TC-11	Infiltration Basin: A shallow impoundment designed to capture and hold stormwater until it infiltrates into underlying soil. Effective at removing most pollutants but requires large areas and may be constrained by soil types.	N		
	Explanation/Description: The soil type is not uniformly conducive to infiltration and will likely not achieve the required infiltration rate.			
TC-12	Retention/Irrigation: Stormwater is captured in cistern, basin, trench, or other storage area and is subsequently used for irrigation of site landscaping.			
	Explanation/Description: No landscape irrigation demand exists for periods of longer than 1 week following an 85 th percentile, 24-hour storm event, and the project is single family residential land use. Due to insufficient demand, harvest and use systems are not beneficial.	N		
	Detention and Settling			

TC-20	Wet Pond: A constructed basin with a permanent pool of water throughout the year. Differ from wetlands because it is of greater depth. Treats stormwater runoff by settling and biological uptake. Explanation/Description: Due to lack of perennial water source to maintain the permanent pool, wet pond is not feasible.	N
TC-21	Constructed Wetland: A constructed basin with permanent pool of shallow water throughout most of year with substantial vegetative coverage. Explanation/Description: Due to lack of perennial water source, constructed wetland is not feasible. Proprietary bioretention planter boxes already have been included in the city design that provides similar performance.	N
TC-22	included in the site design that provides similar performance. Extended Detention Basin: A constructed basin with an outlet designed to detain stormwater for at least 48 hours to allow particles and pollutants to settle. Explanation/Description: This project has incorporated proprietary bioretention planter boxes in addition to increasing the site's time of concentration while reducing runoff volume in post project condition.	N
MP-20	Wetland: Similar to a constructed wetland but a self contained, manufactured module with vegetation that mimics natural wetland processes. Explanation/Description: Due to lack of perennial water source to maintain the permanent pool, wetland is not feasible.	N
	Biofiltration	
TC-30	Vegetated Swale: Open, shallow, vegetated channels that collect and slowly convey runoff through the property. Filters runoff through vegetation, subsoil matrix, and/or underlying soils; traps pollutants, promotes infiltration and reduce flow velocity. Explanation/Description: Vegetated swales shall be considered for each residence for rooftop runoff dispersion for pollutant removal and flow velocity reduction. A vegetated swale will provide other benefits: lengthen the runoff travel time and decrease runoff velocity; provide evapotranspiration during the lengthened travel; and provide some natural infiltration, storage and pollutant removal due to the inherent properties of grass and landscaping. However, the swales within each parcel may not be designed to the recommended length, width and infiltration capabilities due to lot size and soil restrictions mentioned above, nor are they necessarily expected to be implemented, to the expected recommendations, within the private parcel, which will not be regulated or maintained by the HOA.	Y
TC-31	Vegetated Buffer Strip: Vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Removes pollutants by deceleration, settling, and infiltration. Explanation/Description: Not enough pervious sheet flow condition along the proposed street for this BMP to be considered. Vegetated strips shall be considered for each residence for rooftop runoff dispersion for pollutant removal and flow velocity reduction. A vegetated buffer strip will provide the following benefits: lengthen the runoff travel time and decrease runoff velocity; provide evapotranspiration during the lengthened travel; and provide some natural infiltration, storage and pollutant removal due to the inherent properties of grass and landscaping. However, the buffer strips within each parcel may not be designed to the recommended length, width and infiltration capabilities due to lot size and soil restrictions mentioned above, nor are they necessarily expected to be implemented, to the expected recommendations, within the private parcel,	Y

	which will not be regulated or maintained by the HOA.	
TC-32	Bioretention: A soil and plant based filtration strategy that involved capturing stormwater in depressed landscaped areas. Bioretention practices are flexible strategies for using landscaping as treatment. Explanation/Description: Proprietary bioretention planter boxes have been selected to be incorporated into the site design given the primary pollutants of concern and the compact footprint in an urbanized environment.	Y
	Filtration	
TC-40	Media Filter: Usually two-chambered with a pretreatment settling basin and a filter bed filled with sand or other absorptive filter media.	N
	Explanation/Description: Proprietary bioretention planter boxes are already included in the site design.	
MP-40	Media Filter: Similar to constructed media filter but manufactured as self-contained filtering vaults, units, or cartridges.	N
	Explanation/Description: Not included. See explanation for TC-40.	
	Flow Through Separation	
TC-50	Water Quality Inlet: Vaults with chambers including screens, settling areas, and/or filter media to promote settling and/or separation of pollutants from stormwater.	N
	Explanation/Description: Proprietary bioretention planter boxes are already included in the site design.	
MP-50	Wet Vault: A vault with a permanent water pool and internal features to promote settling and/or separation of pollutants from stormwater. Explanation/Description: Proprietary bioretention planter boxes are already	N
	included in the site design. A permanent pool may cause vector issues.	
MP-51	Vortex Separator: Similar to wet vaults but round and use centrifugal action as primary separation mechanism.	N
MP-52	Explanation/Description: Not included. See explanation for TC-50. Drain Inserts: Boxes, trays, or socks with screens or filter fabric and may also	
IVII JZ	include filter media. They are installed in inlets or catch basins and removal effectiveness for pollutants is generally low except for large sediment. Note: Drain inserts cannot be the sole Treatment Control BMP selection for Priority Projects.	N
	Explanation/Description: The proprietary bioretention planter boxes already included in the site design are much more effective treatment devices.	
	Other	
TC-60	Multiple Systems: A system that uses two or more BMPs in series to increase treatment. Useful when one BMP does not provide sufficient treatment alone.	V
	Explanation/Description: The BMP train includes LID BMPs incorporated on-site (pervious area dispersion and tree canopy) to reduce the pollutants/runoff and proprietary bioretention planter boxes to treat the additional pollutants.	Y

6.4.1 Selected BMPs

The treatment control BMPs for this project primarily consist of proprietary bioretention planter boxes (to treat the remaining stormwater pollutants leaving from the individual residential units and street. These proprietary bioretention planter boxes will be sized to treat the 85th percentile design storm depth of 0.76" for Costa Mesa area (Reference: Appendix A. Figure 6.2 of Technical Guidance Document). All the urban runoff (per the design storm depth) from this 3.71 acre project site shall be treated prior to discharge into the local storm drain system.

The California Stormwater Quality Association (CASQA) has provided study results that show the estimated pollutant removal efficiencies for bioretention devices to be highly effective against the primary pollutants of concern:

Pollutant	Removal Rate % ^a
Total Phosphorus	98%
Metals (Cu, Zn, Pb)	22%
TKN	83%
Total Suspended Solids	81%
Organics	80%
Bacteria	84%

a. Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

6.4.2 Hydromodification Control BMPs

Hydromodification Control BMPs may be integrated with LID BMPs to meet the hydromodification performance criteria discussed in Section 5. The LID BMPs that will be integrated in order to satisfy hydromodification performance criteria include the following:

- Impervious area disconnect in the form of rooftop downspout dispersion
- Street tree canopy
- Increase pervious area compared to existing condition
- Bioretention planter boxes

6.4.3 Hydromodification Control Performance Criteria

Per the calculations in Section 5, hydrologic conditions of concern do not exist for this site.

6.4.4 Sizing of BMPs

The proprietary bioretention planter boxes (Katchall or Filterra equivalent) shall be sized by the manufacturers to capture and treat the flows or volumes of water that will be generated by the site's design capture storm. The water quality volume (based on the 85th percentile design storm depth of 0.76" for Costa Mesa area) for each proposed BMP location is summarized below:

BMP ID	Drainage Area	Runoff	85 th Percentile	Water Quality
	(ac)	Coefficient	Design Storm (in)	Volume (cf)
1	1.79	0.60	0.76	2963
2	0.75	0.60	0.76	1241
3	0.49	0.60	0.76	811
4	0.57	0.60	0.76	944

6.4.5 Location of BMPs

A minimum of four (up to six) proprietary bioretention planter boxes will be located onsite at the most downstream location of each sub-watershed area (just before runoff drains into the proposed streets storm water catch basins). The proposed storm drain layout and treatment BMP locations are shown in Section 7.

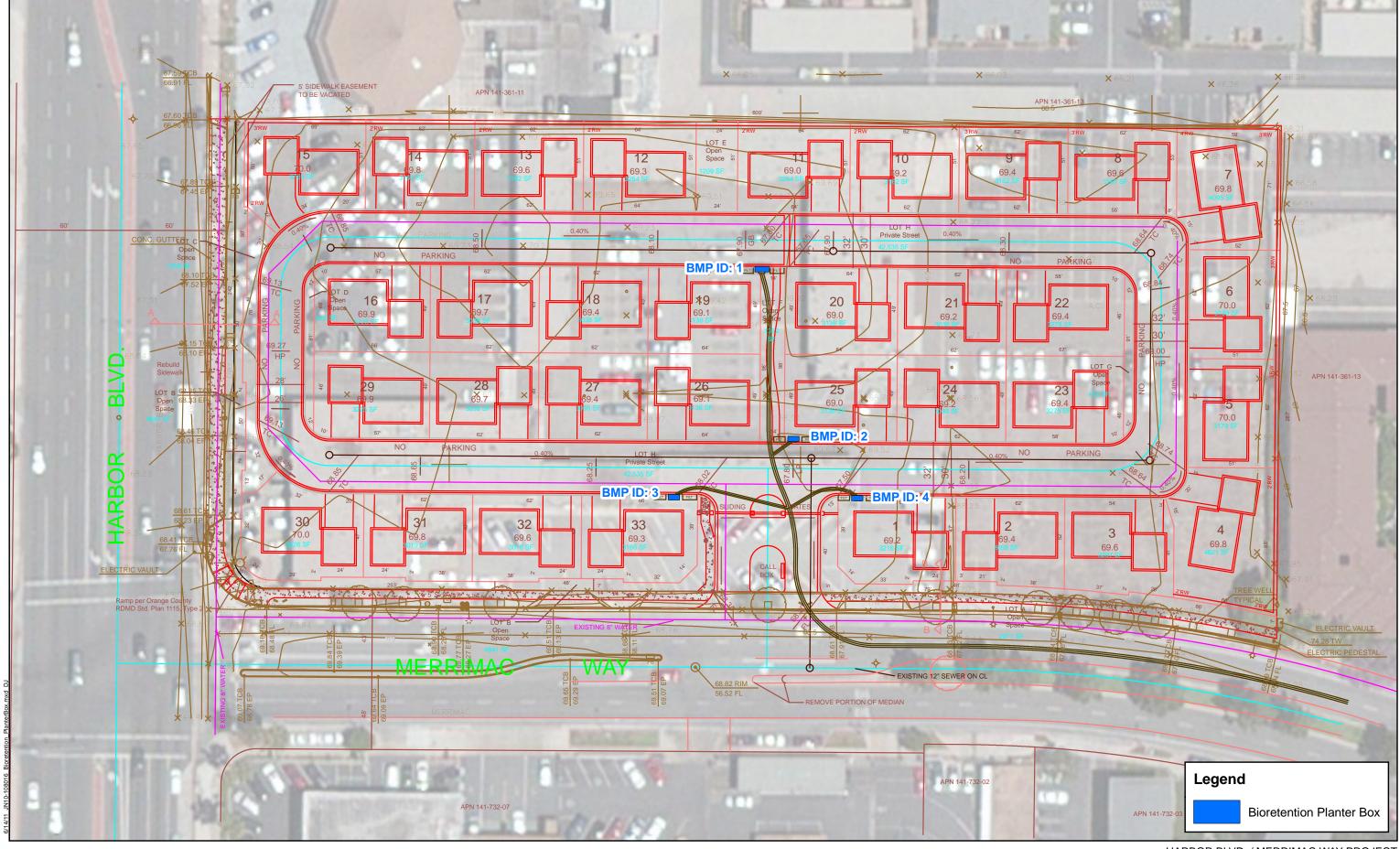
6.5 Restrictions on Use of Infiltration BMPs

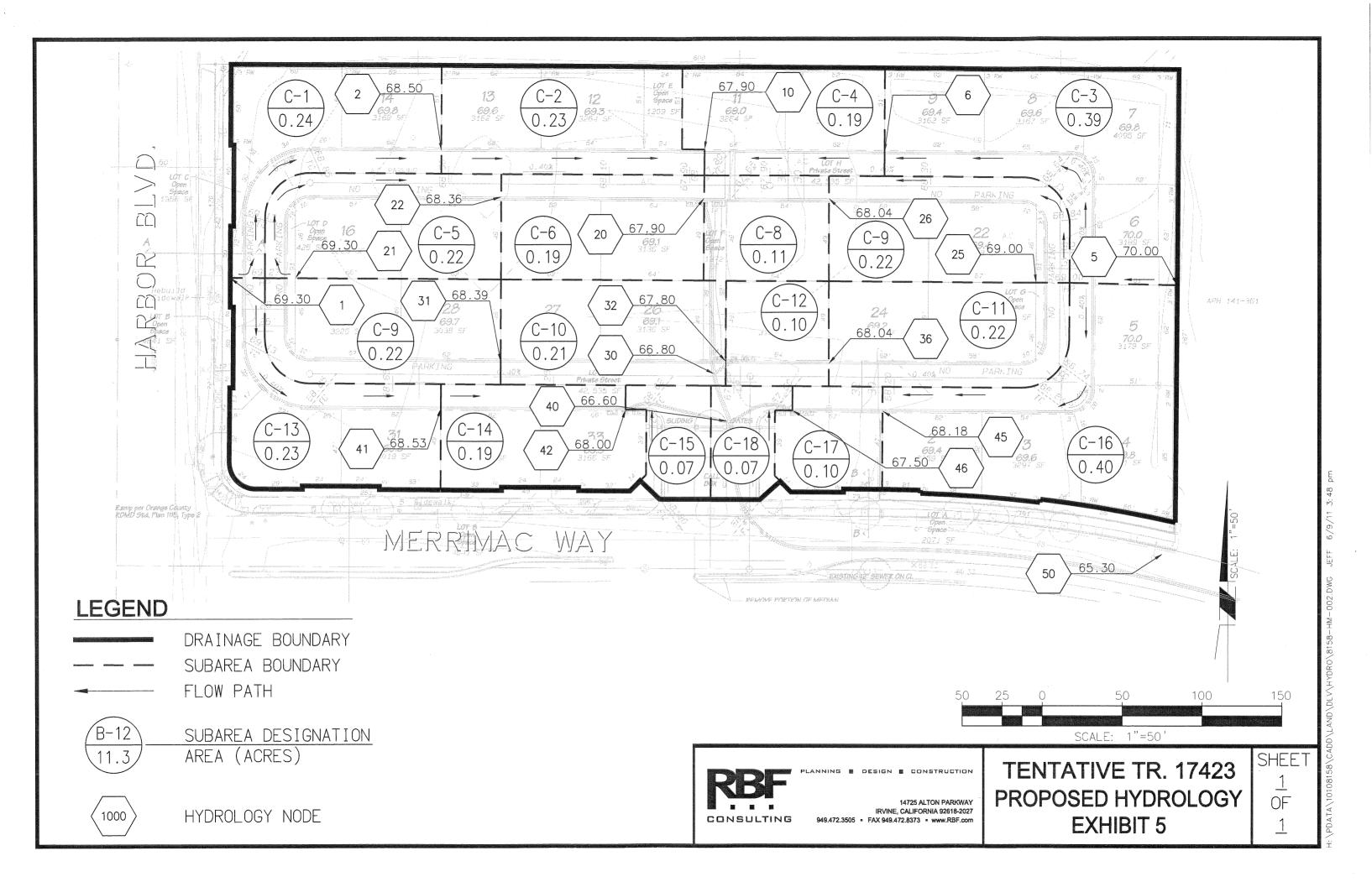
The proposed project does not includes infiltration BMPs (BMPs that are designed to primarily function as infiltration devices)

Section 7 Project Plan and BMP Location Map

Figure 7.1 illustrates the proposed project and the Source Control structural and Treatment BMPs that will be implemented pursuant to this WQMP. The following checklist identifies the required information that is included in the BMP map.

Included	Requirement
х	Legend, north arrow, scale
х	Show drainage arrows, and drainage areas
х	Entire property on one map (provided sufficient detail is shown)
X	Show structures to be constructed and removed
х	Show proposed and existing storm drain systems
Х	Show all external hardscape surfaces such as walkways, driveways, pools, spas, patio areas etc.
X	Indicate the landscape areas and planters
х	Show nearby waterbodies by name, if available
х	Identify site outlet and/or connection to municipal storm drain system
Х	Identify locations of all source control structural and treatment BMPs on the Map. Indicate the BMP location using the BMP number.
х	Differentiate/identify pervious and impervious surfaces, buildings, activity areas, etc.
NA	Identify areas of potential soil erosion (The proposed development is on a mild slope existing car sales lot that is 90% impervious).





Section 8 Stormwater BMP Maintenance

The City does not accept stormwater structural BMPs as meeting the WQMP requirements standard, unless an Operations and Maintenance (O&M) Plan is prepared and a mechanism is in place that will ensure ongoing long-term maintenance of all structural and non-structural BMPs.

The proposed project will implement the following maintenance mechanism to ensure ongoing long-term maintenance of all structural and non-structural BMPs.

The Home Owners Association will be responsible for maintenance and operational performance of all on-site BMPs. Prior to transfer of responsibility to the HOA, the contact information is as follows:

Garrett Calacci
Waterpointe Homes
190 Newport Center Drive
Newport Beach, California 92660
949-644-8900
garrett@waterpointehomes.net

8.1 Operation and Maintenance (O&M) Plan

An O&M Plan will be prepared for the proposed project and must be approved by the City prior to construction approvals, permit close out and issuance of certificates of use and occupancy. The O&M Plan describes the designated responsible party to manage the stormwater BMP(s), employee's training program and duties, operating schedule, inspection and maintenance frequencies, routine service schedule, specific maintenance activities, copies of resource agency permits, and any other necessary activities. At a minimum, maintenance agreements shall require the inspection and servicing of all structural BMPs per manufacturer or engineering specifications. Parties responsible for the O&M plan shall retain records for at least 5 years. These documents shall be made available to the City for inspection upon request at any time.

Desig- nator. Code (e.g. N1 or SC-1)	BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility								
	Source Control Non-Structural BMPs										
N1	Education for Property Owners, Tenants and Occupants	To be implemented at start of occupancy	HOA								
N2	Activity Restrictions	Outlined in CC&Rs	HOA								
N3	Common Area Landscape Management	To be implemented at start of construction phase	НОА								
N4	BMP Maintenance	Maintenance as described herein	HOA								

N6	Local Water Quality Permit Compliance	To be implemented at start of construction phase	Client
N11	Common Area Litter Control	To be implemented as needed to prevent pollution	НОА
N14	Drainage Facility Inspection	o be implemented as needed to prevent pollution	НОА
N15	Street Sweeping Private Streets and Parking Lots	To be implemented weekly or per the City's maintenance schedule	City
	Source Control S	Structural BMPs	
SD-10	Site Design and Landscape Planning	To be implemented during design phase Maintenance as described herein	Various per table
SD-11	Roof Runoff Controls	To be implemented during design and construction phases Maintained to prevent clogging See attached Roof Runoff Controls reference materials (Appendix D)	Homeowner
SD-12	Efficient Irrigation	To be implemented continually	HOA (common areas) Homeowner (residence)
SD-13	Storm Drain System Signs	Implemented during construction phase by Client, but inspect and maintained as needed by HOA	НОА
SD-21	Alternative Building Materials	To be implemented at start of construction	Client
	Treatment Co	ontrol BMPs	
TC-30	Vegetated Swale	See attached maintenance plan (Appendix D)	Homeowner (residence)
TC-31	Vegetated Buffer Strip	See attached maintenance plan (Appendix D)	Homeowner (residence)
TC-32	Bioretention	See attached maintenance plan (Appendix D)	HOA
TC-60	Multiple Systems	Refer to above BMPs	HOA

Required Posting

A statement requiring the above table to be laminated and posted in the primary maintenance worker assembly area(s) related to the project shall be included in the WQMP.

Required Permits

List any permits required for the implementation, operation, and maintenance of the BMPs. Possible examples are:

- Permits for connection to sanitary sewer
- Permits from California Department of Fish and Game
- Encroachment permits

If no permits are required, a statement to that effect should be made.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

WQMP Operations and Maintenance Log									
Designator	Date of	Date of	Verified/						
Code	Inspection	Maintenance	Inspected by	Comments					

Appendix A. Model WQMP References

Table 7.II-2 Antic	ipated and Pot	tential Pollut	ants Gene	erated by Land	l Use Type								
Priority Project	General Pollutant Categories												
Categories and/or Project Features	Suspended Solid/ Sediments	Nutrients	Heavy Metals	Pathogens (Bacteria/ Virus)	Pesticides	Oil & Grease	Toxic Organic Compounds	Trash & Debris					
Detached Residential Development	E	E	N	E	E	Е	N	E					
Attached Residential Development	E	Е	N	E	E	E ⁽²⁾	N	E					
Commercial/ Industrial Development	E ⁽¹⁾	E ⁽¹⁾	E ⁽⁵⁾	E ⁽³⁾	E ⁽¹⁾	Е	E	E					
Automotive Repair Shops	N	N	Е	N	N	E	E	E					
Restaurants	E ⁽¹⁾⁽²⁾	E ⁽¹⁾	E ⁽²⁾	E	E ⁽¹⁾	Е	N	Е					
Hillside Development >5,000 ft ²	E	Е	N	E	E	Е	N	E					
Parking Lots	E	E ⁽¹⁾	Е	E ⁽⁴⁾	E ⁽¹⁾	E	E	E					
Streets, Highways, & Freeways	E	E ⁽¹⁾	Е	E ⁽⁴⁾	E ⁽¹⁾	Е	E	E					
Retail Gasoline Outlets	N	N	Е	N	N	E	E	E					

E = expected to be of concern N = not expected to be of concern

- (1) Expected pollutant if landscaping exists on-site, otherwise not expected.
- (2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
- (3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
- (4) Bacterial indicators are routinely detected in pavement runoff.
- (5) Expected if outdoor storage or metal roofs, otherwise not expected.

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Table 7.I	Table 7.II-3 Summary of the 2006 and 2010 303(d) Listed Water Bodies and Associated Pollutants of Concern for Orange County									r									
		Pollutant																	
Region	Water Body	Bacteria Indicators/ Pathogens		Metals		Nutrients		Pesticides		Toxicity		Trash		Salinity/ TDS/ Chlorides		Turbidity		Other	Organics
		2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List
	Anaheim Bay			Х	Х			Х	Х	Х	Х							Х	Х
	Bolsa Chica Channel			Х	Х														
	Buck Gully Creek	Χ	Х																
	Huntington Beach State Park	Х																Х	Х
۸na	Huntington Harbor	Х	Х	Х	Х			Χ	Х	Х	Х							Х	Х
Region 8 Santa Ana	Los Trancos Creek (Crystal Cove Creek)	Х	Х																
8 6	Newport Bay, Lower			Х		Х	Х	Х	Х	Х	Х							Χ	Х
Region	Newport Bay, Upper (Ecological Reserve)			Х	Х	Х	Х	Х	Х	Х	Х					Х	Х	Х	Х
_	San Diego Creek, Reach 1	Χ	Х	Х	Х	Х	Χ	Χ	Х										
	San Diego Creek, Reach 2			Х															
	Seal Beach	Х	Х															Х	Х
	Silverado Creek	Χ	Х								_		_	Х	Х				

7.II 2-8 May 24, 2010

Table 7.II-3 Summary of the 2006 and 2010¹ 303(d) Listed Water Bodies and Associated Pollutants of Concern for Orange County (Continued)

										Po	olluta	nt							
Region	Water Body		Bacteria Indicators/ Pathogens		Metals		Nutrients		Pesticides		Toxicity		114511	Salinity/ TDS/ Chlorides		Turbidity		Other	C184
		2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List	2006 List	2010 List
	Aliso Creek (Mouth)	Х	Χ																
	Aliso Creek (20 Miles)	Х	Χ			Χ	Χ			Х	Х								
	Dana Point Harbor	Х	Χ		Χ						Х								
	Pacific Ocean Shoreline, Aliso Beach HSA	Х																	
	Pacific Ocean Shoreline, Dana Point HSA	Х																	
Dieg	Pacific Ocean Shoreline, Laguna Beach HSAs	Х																	
an [Pacific Ocean Shoreline, Lower San Juan HSA	Х	Χ																
Region 9 San Diego	Pacific Ocean Shoreline, San Clemente HA at San Clemente City Beach, North Beach	Х	Х																
Regic	Pacific Ocean Shoreline, Other San Clemente and San Joaquin Hills HAs	Х																	
	Pacific Ocean Shoreline, San Mateo Canyon HAs		Х																
	Prima Deshecha Creek				Χ	Χ	Χ									Χ	Χ		
	San Juan Creek	Х	Χ		Χ		Χ	Χ			Х								
	Segunda Deshecha Creek					Χ	Χ				Х					Χ	Χ		

7.II 2-9 May 24, 2010

 $^{^{\}rm 1}$ 2010 303(d) list information will be updated upon approval of the final 303(d) list

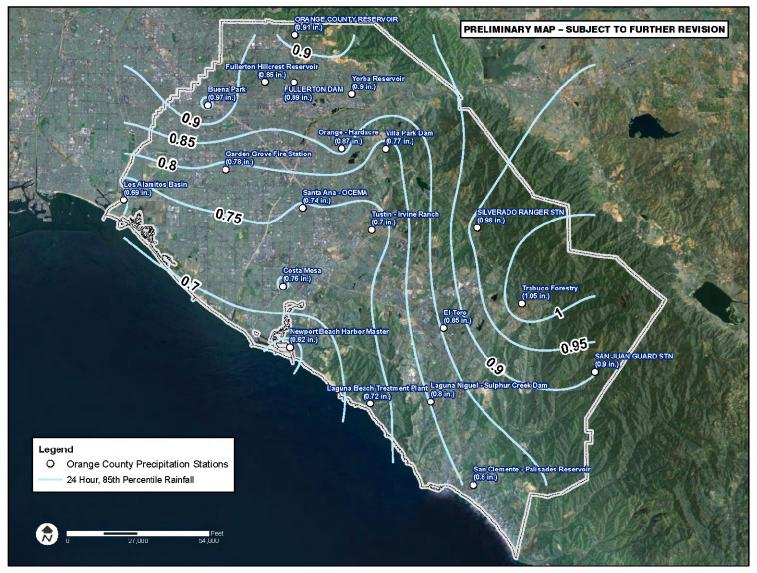
Table 7.II-4 Summary of the Status of TMDLs for Waterbodies in Regions 8 and 9														
		Pollutant												
Region	Water Body	Bacteria Indicators/ Pathogens	Metals	Nutrients	Pesticides	Turbidity/ Siltation								
_	Newport Bay, Lower	Implementation Phase	Technical TMDLs	Implementation Phase	Technical TMDLs	Implementation Phase								
ıta Ana	Newport Bay, Upper (Ecological Reserve)	Implementation Phase	Technical TMDLs	Implementation Phase	Technical TMDLs	Implementation Phase								
Region 8 Santa Ana	San Diego Creek, Reach 1		Technical TMDLs	Implementation Phase	Technical TMDLs and Implementation Phase	Implementation Phase								
ď	San Diego Creek, Reach 2		Technical TMDLs	Implementation Phase		Implementation Phase								
obi	Aliso Creek (20 Miles) Pacific Ocean Shoreline, Laguna Beach HSAs	Implementation Phase												
Region 9 San Diego	Dana Point Harbor Pacific Ocean Shoreline HSAs	Implementation Phase or In Progress												
ion 9	Pacific Ocean Shoreline, San Clemente HA	In Progress												
Regi	San Juan Creek (mouth)	Implementation Phase												

7.II 2-10 May 24, 2010

Figure 6.2

Design Capture Storm Depth for Orange County (85th percentile, 24 hour Isopluvials)

<u>Click Here for Higher Resolution Figure</u>



Appendix B. Hydrology Study

Hydrology Technical Study Tentative Tract 17423

City of Costa Mesa, Orange County, CA

Prepared for City of Costa Mesa 77 Fair Drive Costa Mesa, CA 92626 Contact: Mrs. Minoo Ashabi

> Prepared by RBF Consulting 14725 Alton Parkway Irvine, CA 92618

Contact Rebecca Kinney, RCE 58797 Jeff Langdon, RCE 42429

> June 13, 2011 RBF JN 10-108158



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Appendices

Appendix A: Existing Condition 10-, 25- and 100-year Analysis Appendix B: Proposed Condition 10-, 25-, and 100-year Analysis

Appendix C: 2-year Analysis for Existing and Proposed

1 INTRODUCTION

This study addresses the hydrologic impacts associated with the proposed development of Tentative Tract 17423 (project), located in the City of Costa Mesa, California. The City of Costa Mesa is located in the County of Orange; refer to Exhibit 1: Regional Vicinity Map. The project site is at 2626 Harbor Boulevard at the corner for Harbor Boulevard and Merrimac Way; refer to Exhibit 2: Local Vicinity Map.

The project consists of the construction of thirty-three (33) residential lots, one (1) private street, and seven (7) open space lots on approximately 3.71-acres.

This report is a technical engineering study/evaluation to be used solely to support the environmental document for the project on issues related to drainage, and surface hydrology. The level of analysis prepared is compatible with the level of planning information available.

All assessments and technical analysis in this report are in compliance with the local drainage policies and requirements for the City of Costa Mesa, Orange County, and the California Environmental Quality Act (CEQA) of 1970, as amended. The hydrology analysis has been prepared at a preliminary engineering level based upon the details of the available information for an environmental document.

1.1 History/Background

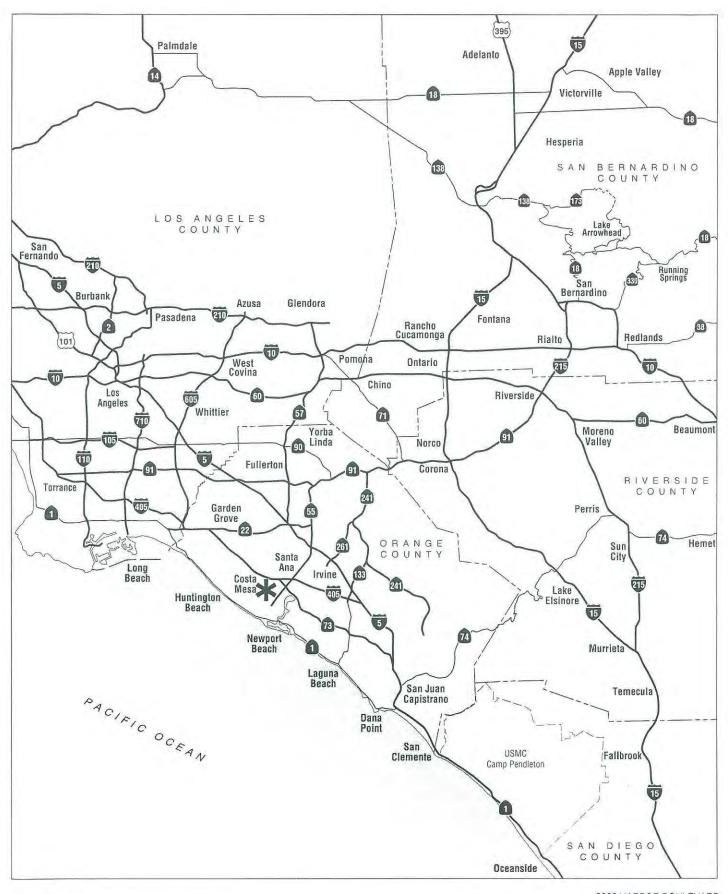
The project site is located in a highly urbanized coastal plain of Orange County. The site is south of the Santa Ana River, and is located within the Santa Ana Delhi Watershed which s tributary to the Upper Newport Bay.

1.2 Definition of Level of Significance

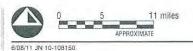
The purpose of this technical evaluation is to determine the impact of the proposed residential development on hydrology, and floodplains within the study area. Should the analysis determine that the proposed project significantly impacts the drainage patterns, hydrology, or floodplains, appropriate mitigation will be identified to minimize the project impacts to less than significant levels.

1.2.1 Flood Control Criteria

Federal, state, and local drainage laws and regulations govern the evaluation of impacts to surface water drainage. For this evaluation, impacts to surface water drainage would be considered significant if the project alters the drainage patterns of the site, resulting in substantial erosion, siltation, or increased run-off that would result in increased flooding in downstream facilities.

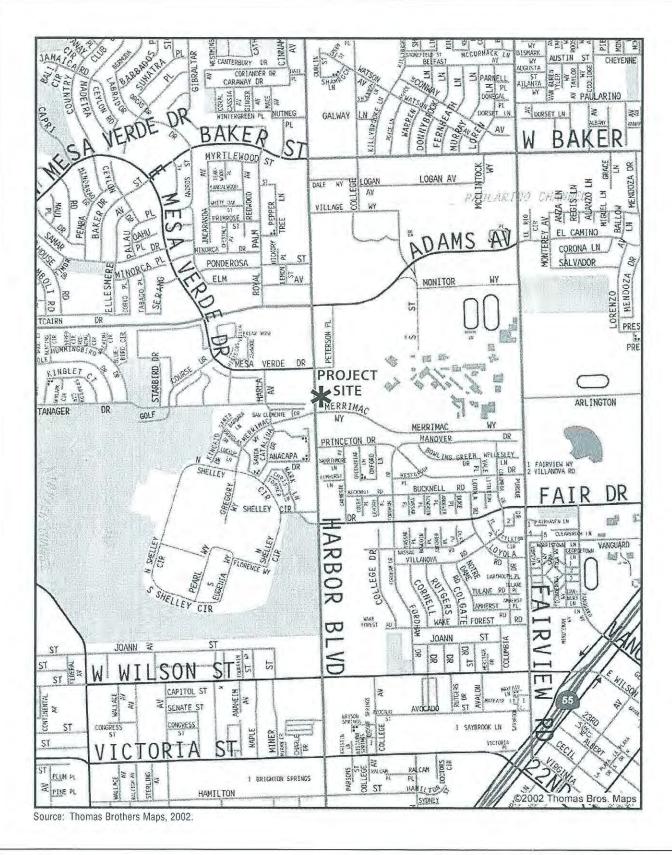






2626 HARBOR BOULEVARD INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

Regional Vicinity



NOT TO SCALE





2626 HARBOR BOULEVARD INITIAL STUDY/M TIGATED NEGATIVE DECLARATION

Local Vicinity

2 EXISTING CONDITION

This section is divided into three sub-sections: 1) existing land use; 2) hydrology; and 3) floodplains. Each sub-section describes different aspects of the existing condition of the project site.

2.1 Existing Land Use

The project site was formerly a Lincoln Mercury car dealership. Two vacant structures associated with the previous auto dealership are located on the project site. The site is comprised entirely of impervious surfaces primarily associated with the former dealership's parking lot. The project site is largely void of vegetation with the exception of a few ornamental trees along the Harbor Boulevard frontage and along the project site's western boundary.

Commercial uses (car dealerships) and a two-story multi-family housing development are located along the project site's northern boundary. Car ports and associated parking from these uses immediately abut the project. East of the project site is a three-story multi-family residential use. The development and associated surface parking, including carports, immediately abut the project.

Merrimac Way borders the project site to the immediate south. Beyond Merrimac Way is an auto dealership with associated mechanics facilities and surface parking. Multi-family residential uses with associated surface parking are also located to the south beyond Merrimac Way. Harbor Boulevard bounds the project site to the west. Beyond Harbor Boulevard is a multi-family residential development as well as Local Business (C1) uses.

For the existing hydrology condition analysis, the project site was considered commercial land use with a percent impervious of 90%.

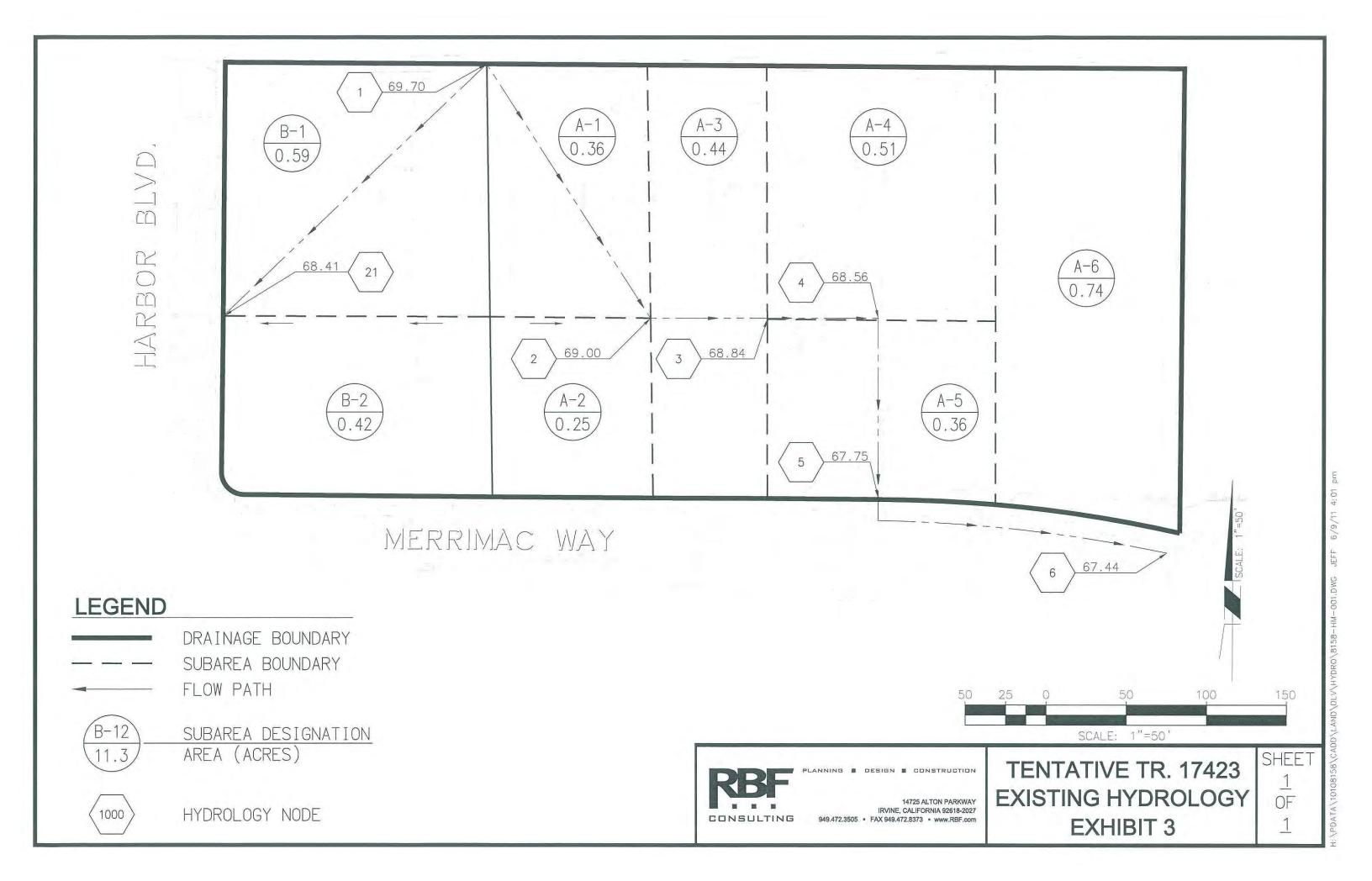
2.2 Hydrology

This sub-section describes the existing condition technical analysis. The sub-section is broken into two parts: Watershed Description and Analysis and Results.

2.2.1 Watershed Description

The existing watershed is broken up into two sub-watersheds: the area draining to Harbor Boulevard and the area draining to Merrimac Way, refer to Exhibit 3: Existing Conditions Hydrology Map. The runoff tributary to Harbor Boulevard (Watershed B) sheet flows from the parking lot to a driveway which outlets the flow onto Harbor Boulevard which eventually makes its way northeastword to F03 (Paularino Channel) which is eventually tributary to the Santa Ana Delhi Channel.

The runoff tributary to Merrimac sheet flows into a ribbon gutter, which eventually discharges to Merrimac Way through a driveway. The flow then continues eastward on Merrimac Way until it enters a catch basin which is tributary to an existing 4.5'Hx8'W RCB. The RCB is eventually tributary to E03 upstream of Pinecreek Drive.



2.2.2 Analysis and Results

For this study, the existing site was delineated based on the topography. The areas were calculated and a rational method hydrology analysis was completed in accordance with Orange County Hydrology Manual Requirements. See Table 2-1 for Existing Condition Results.

Table 2-1: Existing Condition Hydrology Summary

Sub- Watershed	Node	Area (acres)	Total 10-Year Flow Rate Exiting the Site (cfs)	Total 25-Year Flow Rate Exiting the Site (cfs)	Total 100-Year Flow Rate Exiting the Site (cfs)
A	6	2.67	6.12	7.37	9.53
В	21	1.01	2.78	3.48	4.46

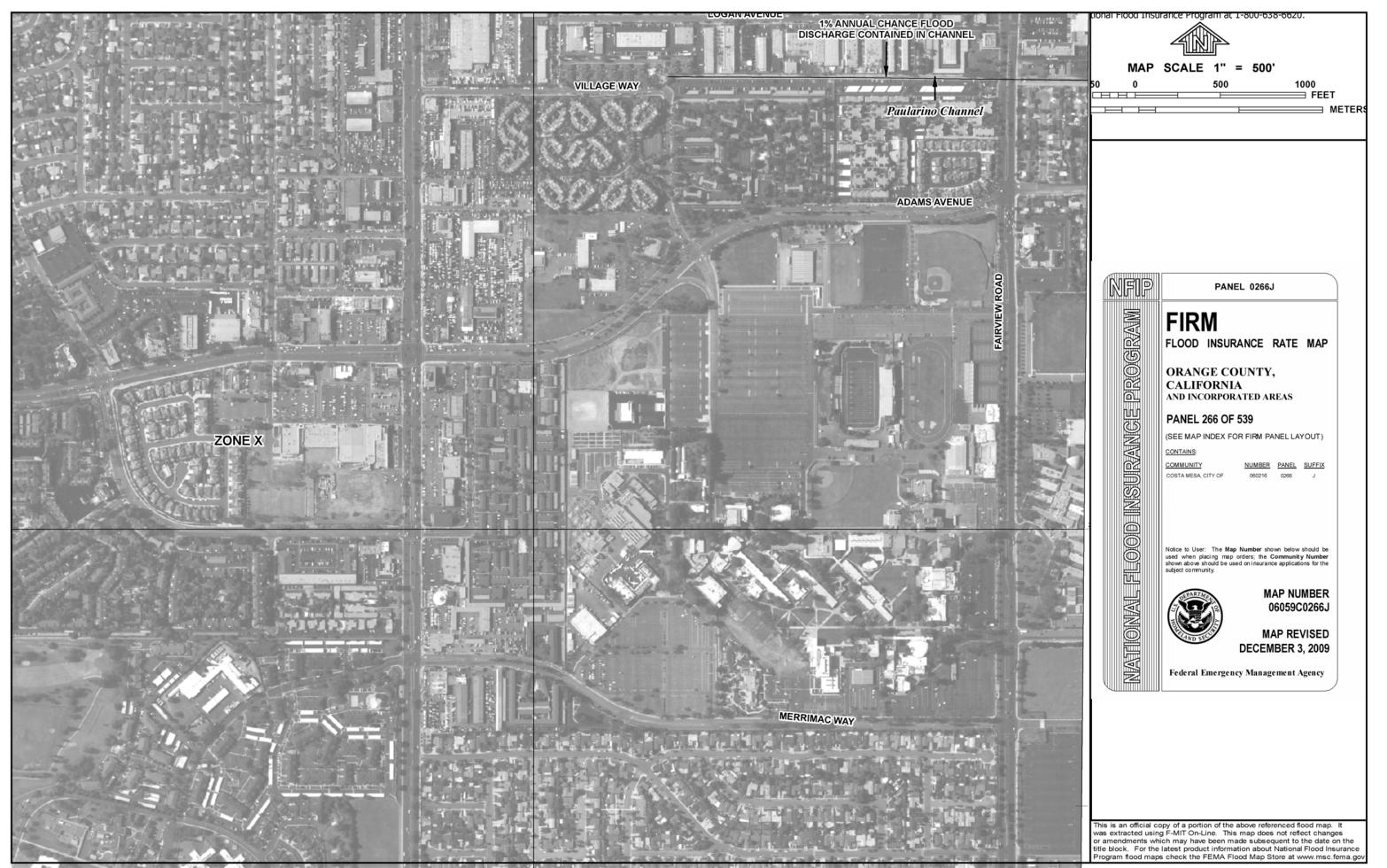
For the water quality Hydrologic Conditions of Concern Analysis, a 2-year storm was analyzed for runoff flowrate, volume and time of concentration for the overall site.

Table 2-2: Existing Condition 2-Year Analysis Summary

Flowrate (cfs)	Volume (Acre-feet)	Time of Concentration (Minutes)
4.82	0.45	11.72

2.3 Floodplains

The published Flood Insurance Rate Maps (FIRMs) for the project site are included on Community Panel No. 06059C0266J. Refer to Exhibit 4: FEMA FIRM Map, for a location of mapped floodplains. The project is located within the FEMA Zone X (Other Flood Areas) designation. FEMA Flood Zone X (Other Flood Areas) designated areas are outside of the 0.2% annual chance floodplain. FEMA Flood Zone X is a moderate to low risk flooding area where flood insurance is available to property owners but not required.



3 PROPOSED CONDITIONS

This section describes the proposed condition technical analysis. The section is broken into three sub-sections: 1) proposed land use; 2) hydrology; and 3) floodplains. Each sub-section describes different aspects of the proposed condition.

3.1 Proposed Land Use

For the proposed condition, the project site was considered one land use: 8-10 dwelling units per acres. The percent impervious for each land use was per the *County of Los Orange Hydrology Manual*; refer to Exhibit 5: Proposed Conditions Hydrology Map and Table 3-1: Proposed Land Use Summary.

Table 3-1: P	Proposed Land	Use Summary
--------------	---------------	-------------

		Total Area	
Sub-			%
Watershed	Node	(ac)	Impervious
С	50	3.6	60%

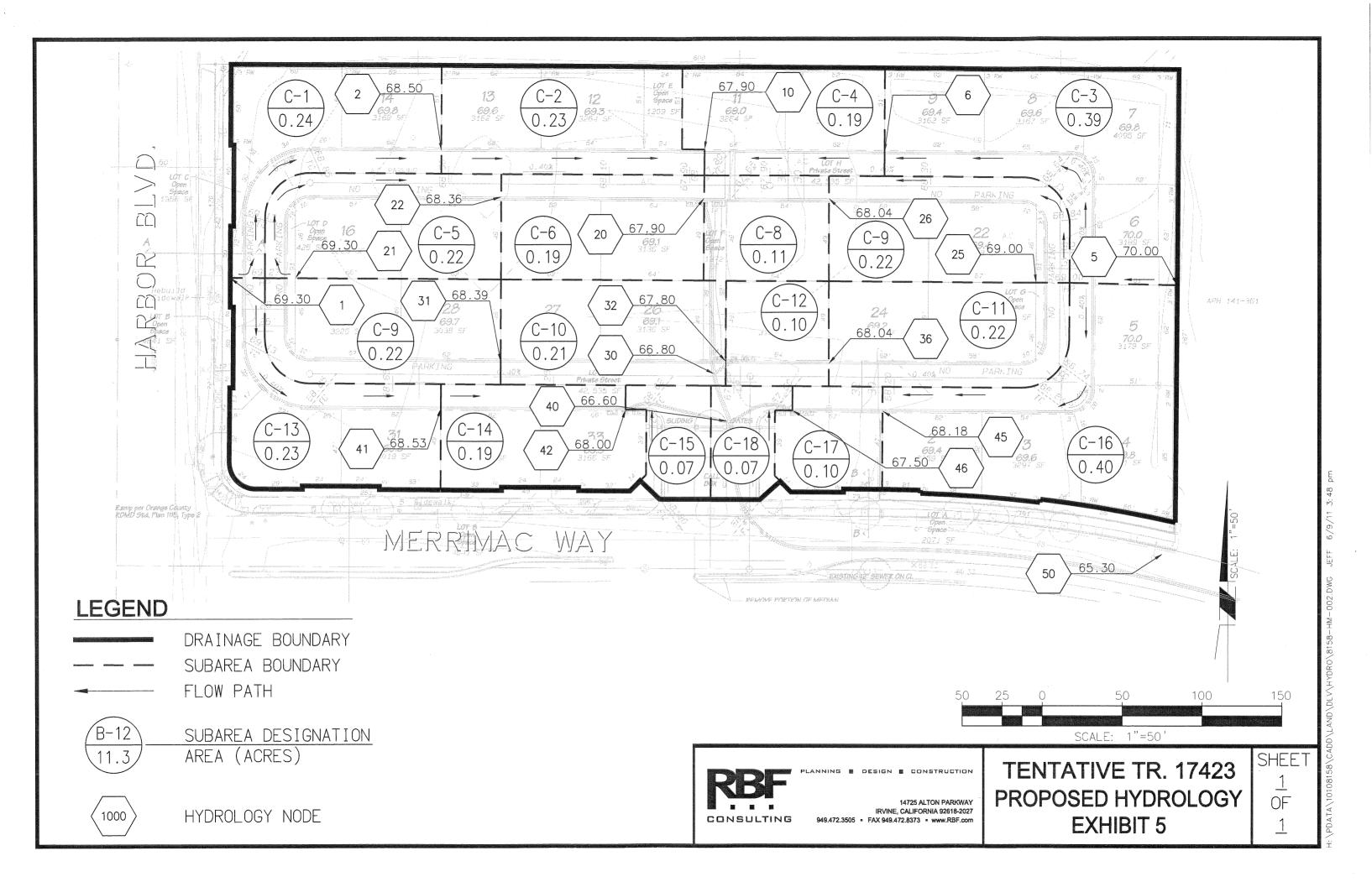
3.2 Hydrology

This sub-section is divided into two parts: 1) Watershed Description and 2) Analysis and Results.

3.2.1 Watershed Description

The proposed watershed is one Sub-watershed that is tributary to a new proposed storm drain pipe that will connect the new onsite storm drain directly to the existing 4.5'Hx8'W box under Merrimac Way (existing discharge point of Existing Condition Watershed A). The watershed tributary to the existing 4.5'Hx8'W box has increased slightly due to the combination of the existing Watershed A and B in the proposed condition (Watershed C). However, the percent impervious has been reduced from 90% to 60%.

The onsite storm drain consists of gutters, catch basins and storm drain to capture the development flow and direct it to the new storm drain extension in Merrimac Way.



3.2.2 Analysis and Results

A proposed conditions hydrology analysis was completed for the 10-, 25-, and 100-year storms for comparison against existing conditions. The proposed condition hydrology was calculated using the Orange County Rational Method Hydrology; refer to Table 3-2: Proposed Hydrology Analysis Summary.

Table 3-2: Proposed Hydrology Analysis Summary

Sub-		Area	Total 10-year Flow Rate	Total 25-year Flow Rate	Total 100-year Flowrate
Watershed	Node	(acres)	(cfs)	(cfs)	(cfs)
С	50	3.60	8.16	9.83	12.68

For the water quality Hydrologic Conditions of Concern Analysis, a 2-year storm was analyzed for runoff flowrate, volume and time of concentration for the overall site.

Table 3-1: Proposed Condition 2-Year Analysis Summary

Flowrate (cfs)	Volume (Acre-feet)	Time of Concentration (Minutes)
4.34	0.27	12.53

3.3 Floodplains

Since the project area is in a Zone X floodplain, which is not a special flood hazard area, no changes to the floodplain will occur as part of the proposed project.

4 IMPACTS

This section describes the proposed condition impact to the watershed. The section is broken into four sub-sections: 1) drainage; 2) hydrology: and 3) floodplains. Each sub-section describes the different impacts caused by the proposed condition.

4.1 Drainage

The proposed project would alter drainage patterns due to on-site grading; refer to Table 4-1: Comparison of Drainage Area Impacts.

Table 4-1: Comparison of Drainage Area Impacts

Sub-	Existing	Conditions	Proposed	l Conditions	Col	mparison
Watershed	Area	%	Area	%	∆ Area	Δ
	(ac)	Impervious	(ac)	Impervious	(ac)	%Impervious
A/C	2.67	90	3.68	60	1.07	-30%
В	1.01	90	0	0	-1.07	

4.2 Hydrology

The results of the impact analysis show that the change in drainage patterns onsite have caused a minor increase in flow to the proposed storm drain in Merrimac. However, overall the flow from the site is decreased to the Paularino Channel. Table 4-2: Comparison of Hydrology shows the results.

Table 4-2: Comparison Hydrology

Sub-	10-Year S	10-Year Storm			torm		100-Year Storm		
Watershed	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	∆ Flowrate	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	∆ Flowrate	Existing Flowrate (cfs)	Proposed Flowrate (cfs)	∆ Flowrate
A/C	6.12	8.16	+2.04	7.37	9.83	+2.46	9.53	12.68	+3.15
В	2.78	0	-2.78	3.48	0	-3.46	4.46	0	-4.46
Total	8.90	8.16	-0.74	10.85	9.83	-1.0	13.99	12.68	-1.31

The results of the 2-year impact analysis show decreases in flowrate and volume, with an increase in Time of Concentration. The proposed land use would bring the hydrology of the 3.68 acres closer to a natural condition due to the increase in pervious area. The impacts of this change on the Santa Ana Delhi will be negligible as the project only represents 0.033% (3.68/11,071 acres) of the watershed.

Table 4-3: 2-year Comparison Hydrology

Parameter	Existing	Proposed	Δ
Flowrate (cfs)	4.82	4.34	-0.48
Volume (acre-feet)	0.45	0.27	0.18
Time of Concentration (min)	11.72	12.53	+0.81

4.3 Floodplains

There are no mapped special flood hazard areas on-site; therefore, there is no impact.

5 PROPOSED MITIGATION

This section describes the mitigation measures required to prevent the proposed project impacts to the watershed. The section is broken into four sub-sections: 1) drainage; 2) hydrology; and 3) floodplains.

5.1 Drainage

Mitigation measures for drainage are listed below:

- Prepare a detailed hydrology study to accurately identify project impacts.
- A new storm drain between the project site and the existing 4.5'H x8W RCB shall be analyzed, designed and constructed.
- All storm drain facilities shall be designed for 25-year storm event protection.

Completion of these drainage mitigation measures would reduce impacts to a less than significant level.

5.2 Hydrology

Refer to mitigation measures outlines in Section 5.1. Completion of these mitigation measures would reduce flooding impacts to less than significant level.

5.3 Floodplain

No mitigation is required.

6 REFERENCES

Orange County Department of Public Works. Orange County Hydrology Manual. October 1986.

County of Orange. *Hydrology Report Santa Ana-Delhi Channel - Facility F01Entire Draiange System.* January 1996.

APPENDIX A: EXISTING CONDITION 10-, 25- AND 100-YEAR ANALYSIS

APPENDIX B: PROPOSED CONDITION 10-, 25-, AND 100-YEAR ANALYSIS

APPENDIX C: 2-YEAR ANALYSIS FOR EXISTING AND PROPOSED

Appendix C. Educational Material

The Ocean Begins at Your Front Door



Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate-free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
 - Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

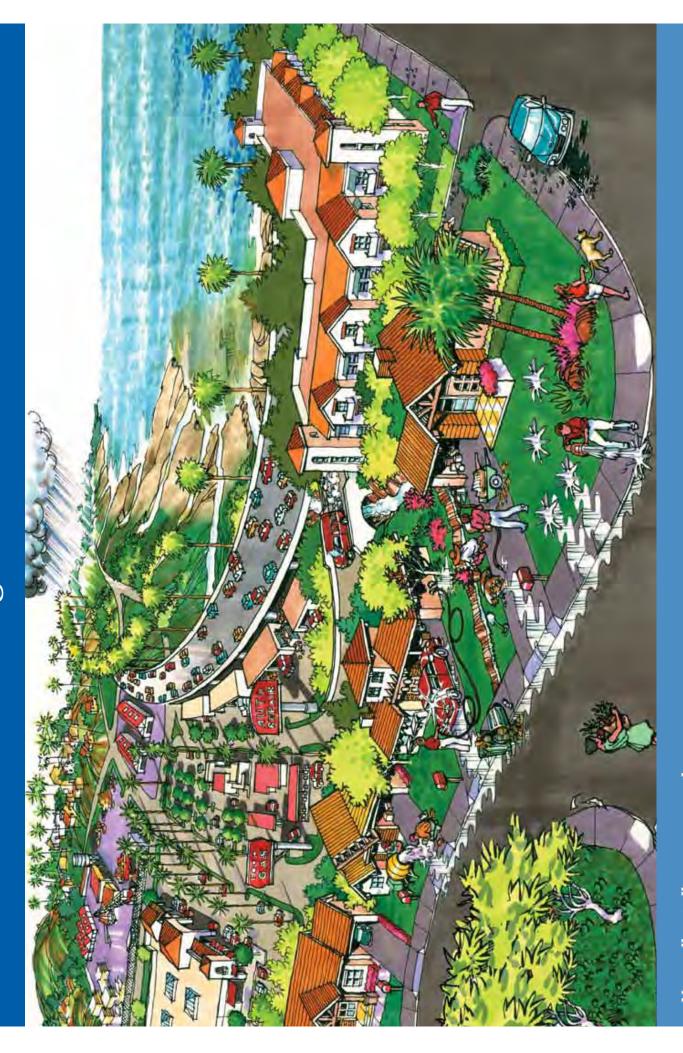
Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and so
 - Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door



Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
 - There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall.
 When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

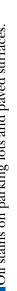
- Anything we use outside homes, vehicles and businesses like motor oil, paint, pesticides, fertilizers and cleaners can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids
- ■Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
 - Pesticides and fertilizers from lawns, gardens and
- Improper disposal of cleaners, paint and paint
- removers.

 Soil erosion and dust debris from landscape and
 - construction activities.

 Litter, lawn clippings, animal waste, and other
- organic matter.
 Oil stains on parking lots and paved surfaces.





The Effect on the Ocean



Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system

can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.



For More Information

Orange County Stormwater Program

California Environmental Protection Agency www.calepa.ca.gov

- Air Resources Board www.arb.ca.gov
- Department of Pesticide Regulation www.cdpr.ca.gov
- Department of Toxic Substances Control www.dtsc.ca.gov
- Integrated Waste Management Board www.ciwmb.ca.gov
- Office of Environmental Health Hazard Assessment www.oehha.ca.gov
- State Water Resources Control Board www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup. org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline

(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange

County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner

(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook

Visit www.cabmphandbooks.com

UC Master Gardener Hotline

(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	425-2535
Anaheim Public Works Operations (714)	765-6860
Brea Engineering	990-7666
Buena Park Public Works (714)	562-3655
Costa Mesa Public Services	754-5323
Cypress Public Works	229-6740
Dana Point Public Works (949)	248-3584
Fountain Valley Public Works (714)	593-4441
Fullerton Engineering Dept(714)	738-6853
Garden Grove Public Works (714)	741-5956
Huntington Beach Public Works (714)	536-5431
Irvine Public Works (949)	724-6315
La Habra Public Services (562)	905-9792
La Palma Public Works	690-3310
Laguna Beach Water Quality (949)	497-0378
Laguna Hills Public Services (949)	707-2650
Laguna Niguel Public Works (949)	362-4337
Laguna Woods Public Works (949)	639-0500
Lake Forest Public Works (949)	461-3480
Los Alamitos Community Dev (562)	431-3538
Mission Viejo Public Works (949)	470-3056
Newport Beach, Code & Water	
Quality Enforcement (949)	644-3215
Orange Public Works (714)	532-6480
Placentia Public Works (714)	993-8245
Rancho Santa Margarita (949)	635-1800
San Clemente Environmental Programs (949)	361-6143
San Juan Capistrano Engineering (949)	234-4413
Santa Ana Public Works (714)	647-3380
Seal Beach Engineering (562) 43	1-2527 x317
Stanton Public Works	
Tustin Public Works/Engineering(714)	573-3150
Villa Park Engineering (714)	998-1500
Westminster Public Works/Engineering (714) 89	8-3311 x446
Yorba Linda Engineering (714)	961-7138
Orange County Stormwater Program (877)	897-7455
Orange County 24-Hour	
Water Pollution Problem Reporting Hotline	200
1-877-89-SPILL (1-877-897-7455)	

On-line Water Pollution Problem Reporting Form

www.ocwatersheds.com



Appendix D. BMP References



Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).
- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

■ The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

Targeted Constituents

\checkmark	Sediment	-
\checkmark	Nutrients	A
\checkmark	Trash	•
\checkmark	Metals	•
\checkmark	Bacteria	•
\checkmark	Oil and Grease	

Legend (Removal Effectiveness)

- Low High
- ▲ Medium

✓ Organics



be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft² of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately

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aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)				
Pollutant	Removal Rate			
Total Phosphorus	70-83%			
Metals (Cu, Zn, Pb)	93-98%			
TKN	68-80%			
Total Suspended Solids	90%			
Organics	90%			
Bacteria	90%			

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

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Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural

soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about \$3 to \$4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between \$10 to \$40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging \$6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at \$111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

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Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of \$24,000 (PGDER, 1993). And a new residential development spent a total of approximately \$100,000 using bioretention cells on each lot instead of nearly \$400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

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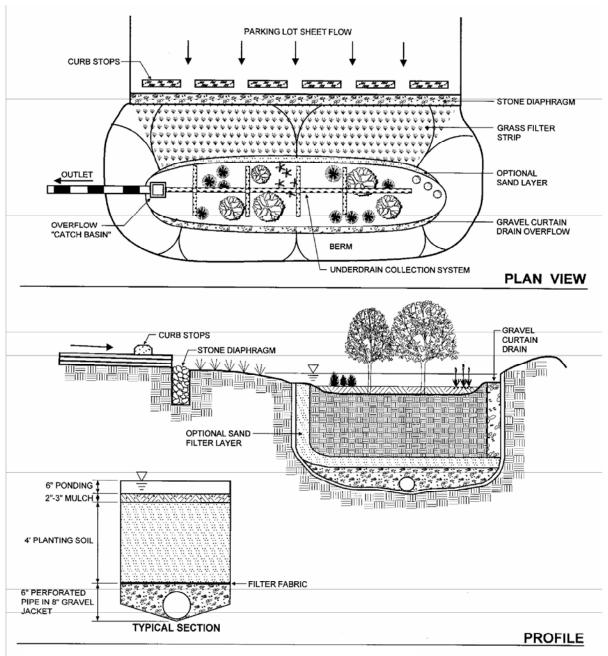
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